

BOSTON PUBLIC LIBRARY



3 9999 06660 960 1

SIXTEENTH ANNUAL REPORT
OF THE
BOSTON WATER BOARD.



1891 - 92.

Accessions

(39146)

Shelf No.

* 6355.50
16. Ann rept
1891/92.




GIVEN BY

Boston Water Board.

June 22, 1892.

With Compliments of

BOSTON WATER BOARD.



Digitized by the Internet Archive
in 2010 with funding from
Boston Public Library

SIXTEENTH ANNUAL REPORT
OF THE
BOSTON WATER BOARD,

FOR THE
Thirteen Months ending January 31, 1892.

Printed for the Department.



BOSTON:
ROCKWELL & CHURCHILL, CITY PRINTERS.
1892.

* 6355.50
16¹/₂ Ann. repts.
1891/92

(39146)

Boston Water Board

June 22, 1892

OFFICE OF THE BOSTON WATER BOARD,
CITY HALL, BOSTON, Feb. 1, 1892.

HON. NATHAN MATTHEWS, Jr.,
Mayor of the City of Boston:

SIR: The Boston Water Board, or Water Supply Department, submit their report for the thirteen months ending Jan. 31, 1892. In accordance with an order of the City Council approved Dec. 5, 1891, this report covers thirteen months instead of the calendar year, which must be kept in mind in comparing the financial figures herein set forth with those contained in the previous reports of this department.

The following is a comprehensive summary of the disbursements by the department for the said thirteen months ending Jan. 31, 1892:

Money expenditures, Cochituate Water-Works (see page 12)	\$1,014,159 93
Money expenditures, Mystic Water-Works (see page 13)	161,643 93
	<hr/>
	\$1,175,803 86
Add decrease in stock during year (see page 14)	38,902 41
	<hr/>
	\$1,214,706 27
	<hr/>
Current expenses, Cochituate Water-Works	\$398,755 93
Current expenses, Mystic Water-Works	163,723 80
Extension of Mains, etc.	311,129 80
Additional Supply of Water	328,854 30
High service	4,136 92
Shops, Albany street	4,390 89
Introduction of meters and inspection, Cochituate	3,207 14
Introduction of meters and inspection, Mystic	507 49
	<hr/>
	\$1,214,706 27
	<hr/>

We submit a brief summary of the principal facts of interest in relation to the work of the department, together with a detailed statement of the doings and condition of the separate divisions.

REVENUE.

The total receipts of the Cochituate Works from all sources for the thirteen months ending Jan. 31, 1892, have been \$1,946,446.16. Of this amount, \$1,838,494.30 was received from sales of water. No rebate was made on the bills for schedule rates issued Jan. 1, 1892, for the reason that it is deemed advisable in lieu thereof to make important reductions in the charges to certain of the city departments for the use of water.

MYSTIC DEBT.

The Sinking Fund for the payment of the Mystic Debt exceeds the amount of the debt \$68,208.70, and action should be taken by the City Council to make some disposition of the surplus revenue.

WATER REGISTRAR'S DEPARTMENT.

In 1890 the Water Registrar's Department was made a separate department by ordinance, under the name of the Water Income Department. In the opinion of this Board the practical working of this separation has been inconvenient and confusing, and interferes with an economical and efficient operation of the water service. By a consolidation of the Water Registrar's with this department a saving of at least \$10,000 could be effected.

EASTERN DIVISION.

On June 1, by appointment of the Board, Mr. William J. Welch assumed the duties of Superintendent of the Eastern Division in place of Mr. Dexter Brackett, resigned.

EXTENSION OF MAINS.

Twenty-one miles of pipe-mains have been laid during the thirteen months, and the total length now connected with the works is 518.79 miles; 2,374 service-pipes have been laid, and 327 hydrants have been put in service, making the present total number 5,705.

For the convenience of the Fire Department a series of

maps has been prepared showing the location of all hydrants, and indicating the number of engines that could be massed at any given point.

CONSUMPTION OF WATER.

The daily average consumption per head of population on the Sudbury and Cochituate supply the past year has been 89.3 gallons, and on the Mystic supply 74.7 gallons, as against 82.5 and 70.6, respectively, the previous year. The yearly daily average consumption has been 37,686,900 gallons on the Cochituate and Sudbury, and 9,055,200 gallons on the Mystic, as against 33,871,700 and 8,301,400, respectively, in 1890.

BASIN 6.

The name of Basin 5 has been changed to Basin 6 for the sake of uniformity. The basins on the Stony-brook branch are now numbered with odd numbers, 1, 3, and 5, and those on the main branch of the Sudbury with even numbers, 2, 4, and 6. The work of construction on the basin has been prosecuted actively from the early spring until late in the fall. The excavation of the trench for the core-wall of the dam has been completed, the core-wall built and the trench refilled. The embankment and wall of the dam is now five feet above the elevation of the lowest part of the valley, and will be nearly if not entirely completed by the end of another season. This work on the trench and wall of the dam has been done by day labor, as in the previous year, by the advice of the City Engineer. The work of stripping the basin and the shallow flowage has been divided into sections, and let by contract as follows :

	Estimated amounts.
Section A. Joseph Gennaro, 30½ cts. per cubic yard . . .	\$24,064 50
Section B. Auguste Saucier, 26 cts. per cubic yard . . .	21,502 00
Section C. Moulton, O'Mahony, & Trumbull, 40 cts. per cubic yard . . .	32,200 00
Section D. Moulton, O'Mahoney, & Trumbull, 62 cts. per cubic yard . . .	37,448 00

This contract work is well advanced, and will probably be completed by the end of another season.

Contracts have also been made for delivering filling for the dam (estimated amount \$57,300); for the supply of cut stone for the gate-chamber (\$2,234); and for the building of the lower section of the wasteway (estimated amount \$9,597.50.)

WHITEHALL POND.

At Whitehall pond surveys and borings are being made for a new dam at the outlet; a dredging-plant, consisting of a dredger and three scows, has been built; and in the spring the work of removing the mud and stumps from the bottom of this reservoir will be undertaken.

CEDAR SWAMP.

The surveys and plans for the acquisition and treatment of the so-called Cedar swamp, which have been delayed by the difficulties of the undertaking, are practically completed, and by the end of another year the Board hope to have begun the work of draining the 1,500 acres of marsh land at the sources of the Sudbury river, from which, as was stated in our last report, we believe that the Sudbury water acquires much of its discoloration and fecundancy in vegetable matter.

ADDITIONAL SUPPLY.

Surveys and borings have already been begun for Basins 5, 7, and 9 on the Stony-brook branch of the Sudbury river, as the growing needs of the city demand that these basins, which will be a continuous series, should be constructed without delay.

MEASURES TO IMPROVE THE QUALITY OF THE SUPPLY.

The main trunk sewer of the Marlboro' sewerage system has been completed and is in working order, and a few connections have already been made. The authorities of Marlboro' have promised that there shall be no delay in the matter of connections, and that by the end of another six months the sewage of that municipality will be diverted from Boston's water-supply. We have paid to Marlboro' the sum of \$41,333.33 due under our contract on the completion of the trunk sewer, and a further amount will be paid when a reasonable number of connections has been made. This will make the total sum contributed by Boston \$62,000. It is obvious that this removal of the sewage of 14,000 people outside the water-shed of the Sudbury river will be a very great benefit to the supply. The quality of the water in Basin 3, on the Stony-brook branch, has never been very good, owing to the close proximity of this basin to the city of Marlboro'. In fact, we have used Basin 3 as little as possible on this account.

A contract has been made between the city of Boston and

the town of Westboro', situated near the head-waters of the Sudbury river, under which the city has agreed to contribute the sum of \$20,000 toward the expense of a sewerage system for that town, whereby the sewage of its 5,000 people will be diverted from the Sudbury water-shed. We are glad to report that the work of construction of this system has been pushed so rapidly that the main trunk sewer will be completed by the middle of the current month (February).

THE FUTURE OF THE SUPPLY.

With the addition of Basin 6 and the series of Basins 5, 7, 9, the storage capacity of the Sudbury and Cochituate supplies (49,000,000 gallons in a dry year) will have been exhausted. We have used, during the present year, on the Cochituate and Sudbury supplies, which furnish water to every district of the city excepting Charlestown, a daily average of 37,686,900 gallons, from which it appears that there is a leeway of less than 12,000,000 gallons between the present necessities and the limit of Boston's water-supply. Of course, in ordinary years, the Sudbury and Cochituate water-sheds yield far more than 49,000,000 gallons, but in a season of drought only 49,000,000 can be counted on. Judging from the ratio of increase of our population we have a sufficient water-supply for ten years, assuming that we have to supply no greater territory, through annexations or otherwise, than at present, and assuming that the water-takers of Charlestown continue to be satisfied with Mystic water. By the end of ten years, however, we shall, in all probability, need an additional supply, and we shall need at that time not merely to know where to go for it, but to have the work of construction well under way and at least a portion of the new supply available for use. In other words, the city ought by the end of another five years to decide upon the source of supply which seems most available in order to allow for the inevitable delays which must ensue before the necessary legislation can be obtained and the consequent loans authorized.

With this end in view, the present Board have already begun to examine into the question of a future supply. During the past six months visits have been made to Lake Winnipiseogee, the Nashua river, and the Deerfield river, and a series of investigations has been mapped out for the ensuing year. It is too early as yet to make any definite statements concerning a probable choice; but we desire to call attention to the fact that we have the subject under careful consideration.

It is undoubtedly true that the rapid growth of neighboring cities and towns is making the problem of a sufficient water-supply for these communities more perplexing from year to year, and it seems not improbable that Boston's future supply may have to be of a metropolitan character; that is to say, of sufficient capacity to relieve other needs than our own.

MAINTENANCE ACCOUNTS, COCHITUATE WATER- WORKS.

(FROM REVENUE.)

JANUARY DRAFT, 1891, TO FEBRUARY DRAFT, 1892 (13 MOS.).

Boston Water Board:

Salaries of two Commissioners, two Clerks, Purchasing Agent, and Messenger	\$14,123 05	
Travelling expenses	1,966 92	
Printing and stationery	521 11	
Advertising, postage, and miscellaneous,	942 67	
	<hr/>	\$17,553 75

Eastern Division:

Salaries of Superintendents, Clerks, and Foreman	\$22,352 18	
Travelling expenses and transportation of men	1,147 54	
Printing and stationery	639 63	
Miscellaneous	544 29	
	<hr/>	24,683 64

Western Division:

Salaries of Superintendent, Assistant Superintendent, and Clerks	\$25,400 99	
Travelling expenses	2,303 82	
Printing and stationery	500 40	
Miscellaneous	372 17	
	<hr/>	28,577 38
New meters and setting	8,449 24	
Meters, repairing	14,418 24	
Workshop, blacksmith-shop, etc., Federal st. (property sold April 23, 1891)	2,802 33	
Machine-shop, Albany st.	8,402 97	
Telephones	1,539 80	
Special agents, salaries, travelling expenses, etc.	2,387 13	
Cochituate Aqueduct	3,264 66	
Sudbury Aqueduct (including \$16,590.68 for lining tunnel)	21,673 27	
	<hr/>	
<i>Carried forward,</i>		\$133,752 41

<i>Brought forward,</i>	\$133,752 41
Main pipe relaying (including stock and labor) .	9,180 83
“ repairing “ “ “ “ .	7,073 76
Hydrants “ “ “ “ “ .	32,147 79
Stopcocks “ “ “ “ “ .	3,282 02
Hydrant and stopcock boxes, and repairing (including stock and labor) .	5,542 46
Tools and repairing (including stock and labor) .	10,244 56
Streets “ “ “ “ “ .	7,933 33
Fountains, “ “ “ “ “ .	3,678 85
Stables, “ “ “ “ “ .	15,729 59
Waste-detection “ “ “ “ “ .	20,166 91
Basins, Framingham and Ashland (including stock and labor) .	21,945 46
Service-pipe repairing (including stock and labor) .	19,608 14
Protection of Sudbury and Cochituate supply .	2,976 91
Inspection of water sources .	1,099 60
High service, Chestnut hill (including fuel, salaries, repairs, etc.) .	21,147 61
High service, East Boston (including fuel, salaries, repairs, etc.) .	2,860 04
High service, West Roxbury (including fuel, salaries, repairs, etc.) .	3,213 97
Albany-street yard .	9,746 99
Chestnut-hill Reservoir (including stable, care of grounds, etc.) .	18,265 61
Parker-hill Reservoir .	1,828 38
Brookline Reservoir .	2,182 15
East Boston and South Boston Reservoirs .	3,424 57
Fisher-hill Reservoir .	1,746 26
Lake Cochituate .	5,962 79
Chestnut-hill driveway .	12,330 59
Taxes .	1,995 36
Damages .	5,344 18
Analyses of water, etc. .	680 00
Merchandise sold (pipes and castings, in cases of emergency) .	182 04
Filtration .	7,869 76
Biological Laboratory .	2,111 87
New dam at Lake Cochituate (balance) .	3,501 14
	<hr/>
	\$398,755 93

MAINTENANCE ACCOUNTS, MYSTIC WATER-WORKS

(FROM REVENUE.)

JANUARY DRAFT, 1891, TO FEBRUARY DRAFT, 1892 (13 MOS.).

Boston Water Board:

Salaries of one Commissioner and one

Assistant Clerk	\$5,200 00
Printing and stationery	38 40
Travelling expenses and miscellaneous,	237 58

 \$5,475 98
Superintendent's Department:

Salaries of Superintendent, Assistant

Superintendent, and Clerk	\$6,480 44
Printing and stationery	94 48
Travelling expenses	67 50
Miscellaneous	30 35

 6,672 77

Engineer's Department	3,403 67
Meters, setting and repairing	2,233 53
Off and on water (labor)	4,067 62
Main-pipe laying (including stock and labor),	2,162 11
" relaying " " "	7,828 98
" repairing " " "	1,635 76
Service-pipe laying " " "	1,837 26
" repairing " " "	2,787 29
Hydrants and gates, repairing (including stock and labor)	5,259 80
Streets, repairing (including stock and labor)	656 04
Lake	11,234 52
Conduit	1,646 97
New meters and setting	395 52
Stables	5,892 90
Reservoir	4,618 85
Pumping service (salaries, wages, fuel, repairs, etc.),	45,399 58
Repair-shop	1,846 89
Fountains	1,022 18
Tools and repairing	577 39
Mystic Sewer (repairs, and pumping and treatment of sewage)	22,034 72
Waste Detection Service	7,582 74
Protection of water sources (including salaries of three Special Agents on Pollution)	5,821 31
Analyses of Water	150 00
Filtration	1,032 89
Damages	10,173 46
Merchandise sold	273 07

 \$163,723 80

DETAILED EXPENDITURES UNDER THE SEVERAL APPROPRIATIONS.

(FROM LOANS.)

JANUARY DRAFT, 1891, TO FEBRUARY DRAFT, 1892 (13 MOS.).

Extension of Mains:

Labor	\$100,717 74
Teaming	6,262 23
Blasting	11,070 75
Water-pipes, contracts	105,494 07
Stock	43,301 30
Miscellaneous	78 93

 \$270,085 27

Stock paid for in previous years (additional)	41,044 53
---	-----------

 \$311,129 80
Additional Supply of Water:

(Account of Basin No. 6, Whitehall pond, Cedar swamp, etc.)

Salaries and labor	\$101,514 29
Materials	29,875 50
Contract, 3 roads in Ashland and Hopkinton (balance)	5,740 15
Contract, filling on Dam No. 6 (on account)	4,671 15
Contract, cut stone, gate-chamber, Dam 6	2,234 00
Contract, stripping Section A, Basin 6 (on account)	14,710 63
Contract, stripping Section B, Basin 6 (on account)	8,925 09
Contract, stripping Section C, Basin 6 (on account)	13,167 86
Contract, stripping Section D, Basin 6 (on account)	21,878 93
Contract, lower section, wasteway, Dam 6	9,761 09
City of Marlboro' on account of contract for a sewerage system to protect city water-supply	41,333 33
Engineering and supplies	16,206 87
Land damages	32,450 00
Teaming	19,808 91
Freights and express	1,615 10
Travelling expenses	1,234 99
Printing, stationery, and advertising	539 25
Miscellaneous	3,187 16

 \$328,854 30

High Service:

Labor on foundation for additional pumping-engine at Chestnut-hill station	\$697 78	
Stock, account extension of fire-ser- vice	2,308 18	
Design and drawings for additional pumping-engine (on account) . . .	1,130 96	
	<hr/>	\$4,136 92

*Introduction of Meters and Inspec-
tion, Cochituate Water-Works:*

New meters and setting from stock paid for in previous years	\$3,207 14
---	------------

*Introduction of Meters and Inspec-
tion, Mystic Water-Works:*

New meters and setting from stock paid for in previous years	\$507 49
---	----------

Shops, Albany Street:

Contract for engine	\$1,438 97	
“ for two boilers	1,730 00	
“ for steam-blower	1,200 00	
Miscellaneous items	21 92	
	<hr/>	\$4,390 89

COST OF CONSTRUCTION, AND CONDITION OF
THE WATER DEBTS.

Cost of construction of Cochituate Works
to Jan. 1, 1891 (including \$453.99
omitted in last report) \$20,995,015 00

Expended from Jan. 1, 1891, to Feb. 1,
1892 (13 months), as follows, viz. :
Additional Supply of Water . \$328,854 30
Extension of Mains, etc. . 311,129 80
High service . . . 4,136 92
Shops, Albany street . . 4,390 89

648,511 91

Cost of construction of Cochituate Water-
Works to Feb. 1, 1892 \$21,643,526 91

The outstanding Cochituate Water Loans
Jan. 1, 1891, were \$16,246,273 98

Issued during the year 1891, as follows :

Appropriation,	{ Additional Supply of Water,	
	{ 4% Loans .	\$137,500 00
"	{ Extension of Mains, etc., 4%	
	{ Loans .	100,000 00
		<hr/>
		\$237,500 00
Paid during year 1891 .		60,000 00
		<hr/>
		177,500 00

Total Cochituate Debt, Feb. 1, 1892 . . \$16,423,773 98

Cochituate Water Sinking-Fund, Jan. 1,
1891 \$5,854,530 21
Cochituate Water Sinking-Fund, Feb. 1,
1892 6,471,545 34

Net Cochituate Water Debt, Jan. 1, 1891 . 10,391,743 77
" " " " Feb. 1, 1892 . 9,952,228 64

Cost of construction of Mystic Works to Jan. 1, 1891	\$1,708,781 59
Cost of construction of Mystic Works to Feb. 1, 1892	<u>1,710,943 70</u>

The outstanding Mystic Water Loans, Jan. 1, 1891, were	\$739,000 00
Paid during year 1891	<u>257,000 00</u>

Total Mystic Debt, Feb. 1, 1892	<u>\$482,000 00</u>
---	---------------------

Mystic Water Sinking-Fund, Jan. 1, 1891	\$719,722 81
“ “ “ Feb. 1, 1892	<u>550,208 70</u>

Net Mystic Water Debt, Jan. 1, 1891	\$19,277 19
“ “ “ “ Feb. 1, 1892	<u>0,000 00</u>

TOTAL MONEY EXPENDITURES, COCHITUATE WATER-
WORKS, FROM JANUARY 1, 1891, TO FEBRUARY
1, 1892.

Stock	\$133,881 14
Labor	389,089 31
Salaries	69,728 68
Travelling expenses	11,071 39
Printing	1,480 06
Stationery	578 68
Advertising	843 35
Postage	160 50
Freights and express	2,168 39
Rents	4,158 04
Gas	283 68
Teaming	28,945 70
Repairs	17,853 04
Land damages, etc.	32,450 00
Taxes	1,995 36
Miscellaneous	11,046 45
Inspection of pipes	2,143 99
Blasting	11,302 54
Water-pipe contracts	114,766 36
Coal and wood	4,844 05
Pumping Service, salaries	11,247 45
“ “ fuel	6,231 82
“ “ repairs	810 28
“ “ oils, etc.	581 97
“ “ small supplies	<u>330 11</u>

Carried forward,

\$857,992 34

<i>Brought forward,</i>	\$857,992	34
Miscellaneous contracts	130,933	72
Engineering	18,486	91
Engineering supplies	479	88
Hay and grain	6,267	08
	<u>\$1,014,159</u>	<u>93</u>

TOTAL MONEY EXPENDITURES, MYSTIC WATER-
WORKS, FROM JANUARY 1, 1891, TO FEBRUARY 1,
1892.

Stock	\$7,444	19
Labor	47,685	35
Salaries	27,175	51
Advertising	37	83
Printing	105	25
Stationery	53	81
Gas	68	80
Postage	14	50
Travelling expenses	2,063	90
Coal and wood	337	97
Freights and express	26	18
Teaming	7	50
Hay and grain	967	59
Damages	10,173	46
Repairs	3,018	54
Miscellaneous	814	15
Water-pipe contract	3,044	74
Telephones	328	81
Pumping Service, salaries	11,895	64
“ “ fuel	16,942	95
“ “ repairs	1,076	09
“ “ oils, etc.	996	71
“ “ small supplies	531	89
“ “ new machinery	8,789	80
Engineering	2,287	00
Mystic Sewerage Station, viz. :		
Salaries and wages	10,681	17
Fuel	1,031	63
Chemicals	2,626	26
Repairs	153	03
Small supplies	1,164	68
New machinery	99	00
	<u>\$161,643</u>	<u>39</u>

STATEMENT OF STOCK ACCOUNTS.

		Increase.	Decrease.
Cochituate Water-Works, viz.:			
Stock on hand Dec. 1, 1890	. . \$14,835 57		
“ “ “ Jan. 1, 1892	. . 25,080 37		
Increase during year	. . <u>\$10,244 80</u>	\$10,244 80	
Mystic Water-Works, viz.:			
Stock on hand Dec. 1, 1890	. . \$7,285 72		
“ “ “ Jan. 1, 1892	. . 5,205 85		
Decrease during year	. . <u>\$2,079 87</u>		\$2,079 87
Extension of Mains, etc., viz.:			
Stock on hand Dec. 1, 1890, as per last report	. . \$35,758 17		
Accumulation of stock from special appropriations in previous years, not heretofore included in the Stock Account of the books at the Water Board office	. . 102,630 98		
Actual stock on hand Dec. 1, 1890	. \$138,389 15		
Stock on hand Jan. 1, 1892	. . 97,344 62		
Actual decrease during year	. . <u>\$41,044 53</u>		41,044 53
High Service, viz.:			
Stock on hand Dec. 1, 1890	. . \$6,951 57		
“ “ “ Jan. 1, 1892	. . 4,643 39		
Decrease during year	. . <u>\$2,308 18</u>		2,308 18
Introduction of Meters and Inspection, Cochituate Water-Works, viz.:			
Stock on hand Dec. 1, 1890	. . \$3,207 14		
Stock on hand Jan. 1, 1892	. . 0,000 00		
Decrease during year	. . <u>\$3,207 14</u>		3,207 14
Introduction of Meters and Inspection, Mystic Water-Works, viz.:			
Stock on hand Dec. 1, 1890	. . \$507 49		
“ “ “ Jan. 1, 1892	. . 000 00		
Decrease during year	. . <u>\$507 49</u>		507 49
		<u>\$10,244 80</u>	<u>\$49,147 21</u>
Total decrease in stock during year	. . . . .		<u>\$38,902 41</u>

Account of Expenditures on Additional Supply Appropriation (Dec., 1889), \$1,045,000.

	From Jan. 1, 1890, Draft to Jan. 1, 1891, inclusive. 1891.	From Feb. 1, 1891, to Jan. 1, 1892, inclusive. 1892.	Total to date of Jan. 31, 1892.
<i>Basin 6 :</i>			
Engineering	\$7,576 21	\$4,552 29	\$12,128 50
Contracts on Basin	22,247 67	64,422 66	86,670 33
City Labor. Superintendent's monthly rolls	200 99	448 00	648 99
Labor and teaming	8,078 91	12,705 07	20,783 98
Materials, Supplies, and Miscellaneous . . .	4,418 51	10,284 09	14,702 60
Totals	\$42,522 29	\$82,412 11	\$134,934 40
<i>Dam 6 :</i>			
Engineering	4,229 53	6,671 67	10,901 20
Contracts on Dam	17,479 27	20,547 97	38,027 24
City Labor { Monthly Rolls	3,335 20	3,539 73	6,874 93
{ Labor and Teaming	89,283 15	84,534 61	173,817 76
Supplies and Miscellaneous	49,134 31	20,892 19	70,026 50
Totals	\$163,461 46	\$136,186 17	\$299,647 63
<i>Whitehall Pond :</i>			
Engineering	1,784 18	1,276 83	3,061 01
Contract (dredging plant)		5,526 70	5,526 70
City labor (" ")		5,649 00	5,649 00
Supplies and Miscellaneous	2,137 99	2,772 15	4,910 14
Totals	\$3,922 17	\$15,224 68	\$19,146 85
<i>Cedar Swamp :</i>			
Engineering	2,570 64	2,128 11	4,698 75
Supplies and Miscellaneous	1,303 41	94 05	1,397 46
Land Damages		15,750 00	15,750 00
Totals	\$3,874 05	\$17,972 16	\$21,846 21
<i>Chattanooga :</i>			
Engineering		78 00	78 00
Land		16,000 00	16,000 00
Totals		\$16,078 00	\$16,078 00

Account of Expenditures on Additional Supply Appropriation. — (Continued).

	From Jan. 1, 1890, Draft to Jan. 1, 1891, inclusive. 1891.	From Feb. 1, 1891, to Jan. 1, 1892, inclusive. 1892.	Total to date of Jan. 31, 1892.
<i>City of Marlboro' :</i>			
Drainage		\$41,333 33	\$41,333 33
<i>Basin 5:</i>			
Engineering		514 00	514 00

RECAPITULATION.

Basin 6	\$42,522 29	\$92,412 11	\$134,934 40
Dam 6	163,461 46	136,186 17	299,647 63
Whitehall Pond	3,922 17	15,224 68	19,146 85
Cedar Swamp	3,874 05	17,972 16	21,846 21
Chattanooga		16,078 00	16,078 00
City of Marlboro'		41,333 33	41,333 33
Basin 5 (Surveys)		514 00	514 00
Totals	\$213,779 97	\$319,720 45	\$533,500 42

Contracts Made and Pending during Year commencing January 1, 1891, and ending January 31, 1892.

DATE.	CONTRACTORS.	WORK.	AMOUNT.	PAID ON CONTRACT.		
				Previous Years.	Year 1891.	Total.
1890.						
*Jan. 11,	R. D. Wood & Co.	Water-pipes and Special Castings	\$20.34 per ton of 2,240 lbs.	\$77,330 59	\$11,438 84	\$88,769 43
*Mar. 10,	Osgood & Hart	Iron and service-box castings, year ending Mar. 15, '91.	{ Iron castings, 2c. per lb. { Service-box castings, 2½c. per lb. }	7,200 70	4,204 28	11,413 98
* " 15,	Boston Standard Metal Co.	Brass castings for year ending Mar. 15, 1891	{ Composition, No. 1, 21c. per lb. { Composition, No. 2, 19c. per lb. { Composition, No. 3, 17½c. per lb. }	5,718 64	2,058 71	7,777 35
* " 19,	R. D. Wood & Co.	Water-pipes and Special Castings	\$31.40 per ton of 2,240 lbs.	41,000 04	5,777 07	46,807 11
*Apr. 22,	Roberts Iron Works Co. .	Three boilers, Mystic Pumping-Station	\$8,465.00 . . . . .	. . . . .	8,502 82	8,502 82
" 26,	D. H. Cram	Rental of derricks for use at Basin 5	\$200 each 1st year, \$100 each after.	1,600 00	300 00	
*May 2,	Newell and Snawling . .	Three roads, Ashland and Hopkinton	(Estimated) \$21,285	21,575 67	5,740 15	27,315 82
* " 10,	E. Hodge & Co.	Two boilers, machine-shop, Albany street	\$1,730 . . . . .	. . . . .	1,730 00	1,730 00
* " 28,	Darrow, Mann, & Co. . .	2,400 tons Cumberland coal, Mystic Pumping Station,	\$3.80 per ton 2,240 lbs. on cars . .	5,563 53	3,726 09	9,289 67
*Sept. 12,	B. F. Sturtevant & Co. .	Heating apparatus, shop, Albany street.	\$1,200.00 . . . . .	. . . . .	1,200 00	1,200 00
* " 26,	Waldo Bros.	2,500 barrels cement, Dam 5	\$1.14 per bbl. deliv'd at Ashland .	1,140 00	1,710 00	2,850 00
*Oct. 16,	Mellert Foundry and Machine Co.	Twenty 6x6 3-way branches, 2½c. per lb. delivered .	\$99.31 . . . . .	. . . . .	99 81	99 81
* " 31,	William T. Davern . . .	Blasting, Dean avenue, Dorchester	\$2.75 per cubic yard . . . . .	. . . . .	117 15	117 15
* " 31,	James McLaughlin & Son .	Blasting, court off Dorchester avenue	\$3.95 per cubic yard . . . . .	. . . . .	152 08	152 08
* Nov. 3,	James F. Davern	Blasting, Grainger street, Roxbury	\$3.10 per cubic yard . . . . .	. . . . .	175 46	175 46

Contracts Made and Pending during Year. — Continued.

DATE.	CONTRACTORS.	WORK.	AMOUNT.	PAID ON CONTRACT.		
				Previous Years.	Year 1891.	Total.
1890.						
*Nov. 3,	Martin F. Kiley	Blasting, Holborn place, Roxbury	\$2.64 per cubic yard . . . . .	.....	\$62 57	\$62 57
* " 21,	Martin F. Kiley	Blasting, Hartford terrace, Dorchester	\$4.50 per cubic yard . . . . .	.....	30 60	30 60
*Dec. 1,	Thomas Burke	Blasting, Dean avenue, Dorchester	\$4.00 per cubic yard . . . . .	.....	43 60	43 60
1891.						
Jan. 1,	R. D. Wood & Co.	Water-pipes and Special Castings	\$27.95 per ton 2,240 lbs. . . . .	.....	\$7,463 94	
* " 21,	Yale and Towne Manufacturing Co.	Overhead Track, machine-shop, Albany street	\$723.00 f.o.b. at works . . . . .	.....	723 00	723 00
† " 29,	Charles H. Hale	Filling on Dam No. 5, Ashland	(Estimated) \$57,300 . . . . .	.....	2,739 08	
*Feb. 20,	R. D. Wood & Co.	75 tons 36-inch pipe, and 5 tons Specials, Dam No. 5, Ashland.	{ \$27.90 per ton pipe. On cars in } { \$62.72 per ton specials. On cars } in Ashland.	.....	2,303 63	2,303 63
* " 25,	McNeal Pipe and Foundry Co.	12 tons 48-inch Specials for Dam No. 5	\$38.80. On cars in Ashland . . . . .	.....	711 38	711 38
* " 25,	Cape Ann Granite Co.	Furnishing cut granite at Dam No. 5	\$2,234.00 . . . . .	.....	2,234 00	2,234 0
*Mar. 2,	Martin F. Kiley	Blasting, Humboldt avenue, Roxbury	\$4.45 per cubic yard . . . . .	.....	2,014 27	2,014 27
" 6,	Pierce F. Loneragan	Teaming pipes, etc., for year ending Mar. 15, 1892	{ 74c. per ton 2½ miles, \$1.35 per ton over 2½ miles. }	.....	3,643 17	
" 9,	Osgood & Hart	Iron and Service Box-castings	2c. per lb. . . . .	.....	10,274 25	
" 9,	William Curley	Brass Castings	{ Composition, No. 1, 18½c. per lb. { Composition, No. 2, 16½c. per lb. { Composition, No. 3, 16c. per lb.	.....	3,789 08	

WATER-SUPPLY DEPARTMENT.

19

1891.	Thomas Burke	Blasting, Field street, Roxbury	\$5.50 per cubic yard	202 95	202 95
"	*Mar. 27, Martin F. Kelley	Blasting, Monroe street, Roxbury	\$3.83 per cubic yard	183 84	183 84
"	*Apr. 1, Thomas Burke	Blasting, Magnolia street, Dorchester	\$3.50 per cubic yard	48 30	48 30
"	" 14, Charles H. Williams	3,000 tons Cumberland coal, Mystic Water-Works	$\left\{ \begin{array}{l} \text{per ton of 2,240 lbs. deliv'd} \\ \text{on cars of the Boston \&} \\ \text{Lowell R.R. at Mystic} \end{array} \right\}$	11,522 82	11,522 82
"	" 22, Thomas & Co.	600 tons Cumberland coal, Chestnut-Hill Pumping-Station	\$4.85 $\left\{ \begin{array}{l} \text{per ton of 2,240 lbs. in} \\ \text{bins.} \end{array} \right\}$	2,830 58	2,830 58
"	*Apr. 30, Thomas Burke	Blasting, Cuninghams street, Dorchester	\$3.18 per cubic yard	40 39	40 39
"	*May 4, John Berry	$\left\{ \begin{array}{l} \text{Hauling 36-inch pipes from cars in Ashland to} \\ \text{Basin No. 5.} \end{array} \right\}$	\$2.25 per pipe	78 75	78 75
"	" 12, Martin F. Kelley	Blasting, Baker court, Dorchester	\$3.90 per cubic yard	42 51	42 51
"	" 15, Thomas Burke	Blasting, Putnam place, Roxbury	\$3.40 per cubic yard	162 86	162 86
"	" 20, Edward C. Leonard	Blasting, Morton street, Dorchester	\$4.95 per cubic yard	518 27	518 27
"	" 25, James McLaughlin & Son,	Blasting, Bearse and Vose streets, Dorchester	\$5.45 per cubic yard	386 24	386 24
"	" 25, Charles H. Hale	Lower Section of Wasteway, Dam 5	(Estimated) \$9,597.50	9,761 09	9,761 09
"	" 26, Town of Westboro'	$\left\{ \begin{array}{l} \text{System of Sewage disposal to remove sewage of} \\ \text{town outside of Sudbury-river water-shed.} \end{array} \right\}$	\$20,000.		
"	*June 18, B. C. Tinkham	Blasting, Alger street, South Boston	\$5.00 per cubic yard	312 50	312 50
"	" 18, J. C. Coleman	Blasting, Hutchins avenue, Roxbury	\$7.23 per cubic yard	361 50	361 50
"	*July 2, Martin F. Kelley	Blasting, Rill street, Dorchester	\$4.60 per cubic yard	81 88	81 88
"	" 10, J. C. Coleman	Blasting, Warren street, Brighton	\$4.75 per cubic yard	225 15	225 15
"	" 13, Auguste Saucier	Excavation, Section B, Basin No. 6	26 cents per cubic yard	8,925 09	8,925 09
"	" 14, Joseph Gennaro	Excavation, Section A, Basin No. 6	30½ cents per cubic yard	14,710 63	14,710 63

Contracts marked with (*) are completed.

† Forfeited.

Contracts Made and Pending during Year. — *Concluded.*

DATE.	CONTRACTORS.	WORK.	AMOUNT.	PAID ON CONTRACT.		
				Previous Years.	Year 1891.	Total.
1891.						
July 15,	{ Moulton, O'Mahoney, & Trumbull }	Excavation, Section C, Basin No. 6	40 cents per cubic yard . . . . .	.....	\$13,167 86	
" 15,	{ Moulton, O'Mahoney, & Trumbull }	Excavation, Section D, Basin No. 6	62 cents per cubic yard . . . . .	.....	21,878 93	
* " 15,	David S. B. Chew	350 tons 12-in. A pipes	\$27.25 per ton, delivered . . . . .	.....	9,648 58	\$9,648 58
* " 18,	Martin F. Kelley	Blasting, Granger street, Roxbury	\$4.50 per cubic yard . . . . .	.....	100 35	100 35
* " 20,	Martin F. Kelley	Blasting, Dalmatia street, Roxbury	\$4.85 per cubic yard . . . . .	.....	37 83	37 83
* " 30,	David Truesdale	Blasting, Hawthorne avenue, Roxbury	\$3.50 per cubic yard . . . . .	.....	55 30	55 30
* Aug. 6,	Martin F. Kelley	Blasting, street off Norfolk street, Dorchester	\$5.85 per cubic yard . . . . .	.....	36 86	36 86
* " 12,	Martin F. Kelley	Blasting, Selkirk road, Brighton	\$5.50 per cubic yard . . . . .	.....	58 30	58 30
* " 15,	Thomas Burke	Blasting, Mt. Everett street, Dorchester	\$3.38 per cubic yard . . . . .	.....	84 50	84 50
* " 25,	Patrick Connell	Blasting, Dalmatia street, Dorchester	\$3.00 per cubic yard . . . . .	.....	26 70	26 70
* Sept. 11,	Martin F. Kelley	Blasting, Tileston avenue, Dorchester	\$2.99 per cubic yard . . . . .	.....	93 89	93 89
* " 11,	R. F. Keough	{ One Mud-scow for Whitehall pond (launched at } { Whitehall pond) }	\$1,438.35 . . . . .	.....	1,438 35	1,438 35
* " 17,	Pierce F. Lonergan	Blasting, Fuller street, Dorchester	\$5.00 per cubic yard . . . . .	.....	25 50	25 50
* " 19,	Patrick Connell	Blasting, Centre street, West Roxbury	\$3.50 per cubic yard . . . . .	.....	47 95	47 95
* " 28,	Pierce F. Lonergan	Blasting, Centre street, West Roxbury	\$3.49 per cubic yard . . . . .	.....	106 79	106 79
* " 28,	R. F. Keough	{ One Mud-scow (additional) for Whitehall pond } { (launched at pond) }	\$1,438.35 . . . . .	.....	1,438 35	1,438 35

GENERAL STATISTICS.

SCDBURY AND COCHITUATE WORKS.	1889.	1890.	1891.
Daily average consumption in gallons . .	32,070,000	33,871,700	37,686,980
Daily average consumption in gallons per inhabitant	80.3	82.5	89.3
Daily average amount used through meters, gallons	\$,118,800	9,034,800	10,186,400
Percentage of total consumption metered,	25.3	26.7	27.0
Number of services	58,810	60,718	62,877
Number of meters and motors	3,882	4,078	4,357
Length of supply and distributing mains, in miles	479.72	498.73	519
Number of fire-hydrants in use	5,225	5,398	5,643
Yearly revenue from water-rates	\$1,357,738 30	\$1,382,422 53	* \$1,838,494 30
Yearly revenue from metered water . . .	\$493,239 58	\$554,047 36	† \$606,451 00
Percentage of total revenue from metered water	36.3	40.1	33
Cost of works on Jan. 1, 1889, and 1890, Feb. 1, 1892	\$20,432,974 43	\$20,995,015 00	* \$21,643,526 91
Yearly expense of maintenance	\$345,986 88	\$381,147 10	* \$398,755 92
MYSTIC WORKS.			
Daily average consumption in gallons . .	7,830,500	8,341,400	9,055,200
Daily average consumption in gallons per inhabitant	68.7	70.6	74.7
Daily average amount used through meters, gallons	1,341,700	1,537,400	1,845,500
Percentage of total consumption metered,	17.1	18.5	20.4
Number of services	18,527	19,520	20,566
Number of meters and motors	413	414	427
Length of supply and distributing mains, in miles	147.7	152.3	158
Number of fire-hydrants in use	998	1,073	1,116
Yearly revenue from water-rates	\$317,197 29	\$332,634 02	* \$406,784 26
Yearly revenue from metered water . . .	\$80,313 19	\$89,526 42	† \$102,719 26
Percentage of total revenue from metered water	24.1	26.9	25.2
Cost of works on Jan. 1, 1889, and 1890, and Feb. 1, 1892	\$1,606,280 76	\$1,708,781 59	\$1,710,943 70
Yearly expense of maintenance	\$125,660 21	\$144,184 44	* \$174,421 92

* Thirteen months.

† Twelve months.

Respectfully submitted,

ROBERT GRANT,
JOHN W. LEIGHTON,
THOMAS F. DOHERTY,
Boston Water Board.

REPORT OF THE SUPERINTENDENT OF THE
EASTERN DIVISION.

OFFICE OF SUPERINTENDENT OF EASTERN DIVISION,
710 ALBANY STREET, BOSTON, Feb. 1, 1892.

ROBERT GRANT, Esq., *Chairman Boston Water Board.*

DEAR SIR: I herewith respectfully submit the annual report of the Eastern Division for the year ending Jan. 31, 1892.

Distribution. — Twenty-one miles of pipe mains have been laid during the year, and 5,258 feet of pipe have been abandoned, making a net increase in the distribution system of twenty miles and a total length of 518.79 miles now connected with the works.

Two thousand and eighteen feet of 24-inch pipe main have been laid through the Arnold Arboretum for the improvement of the West Roxbury high-service supply.

For the improvement of the South Boston and Dorchester supply, 3,998 feet of 30-inch pipe main have been laid through Chester square, Chester park, East Chester park, and Swett street. Owing to the large increase in the number of petitions for small extensions of pipe mains, work had to be temporarily suspended on this pipe, but it will be resumed as speedily as possible.

The Bellevue high-service pipes have been extended 1,379 feet through Church and Centre streets and connected to Montclair avenue. A 12-inch check-valve also was put in at the corner of Pond and May streets, and the water turned on to the pipes in Pond street, between May street and Brookline line, April 28, 1891.

Three hundred and seven petitions for extension of mains have been received, and 277, including 11 of 1890, have been granted.

Hydrants. — Three hundred and twenty-seven hydrants have been established and eighty abandoned, making a net increase of 247 and a total of 5,705 hydrants now connected with the system.

Thirty-four of the old pattern Boston hydrants have been replaced by hydrants of the Post or Lowry patterns. During the year 160 Post hydrants in service have been supplied with 4½-inch steamer connections as requested by the Fire Department.

The work of improving the Post hydrant, so as to have an

independent shut-off or valve for each steamer connection, is being pushed as speedily as possible.

Service Pipes. — Two thousand three hundred and seventy-four service pipes have been laid, with an aggregate length of 69,859 feet, and 215 services have been abandoned, making a net increase of 2,159 pipes for the year.

HIGH-SERVICE WORKS.

Chestnut-Hill Station. — The following repairs have been made on Engine No. 1: One full set of Babbitt packing-rings for piston-rods and valve-stems (12 set); 4 wrought-iron cross heads with steel pins, to replace the cast-iron ones, which were badly worn; brasses on both ends of air-pump rods; 1 set of air-pump valves; and 2 gibbs for left side of fork-rod.

Engine No. 2. One full set of Babbitt packing-rings for piston-rods and valve-stems (12 set); 4 wrought-iron cross-heads with steel pins, to replace the cast-iron ones, which were badly worn; brasses on both ends of air-pump rods; 1 strap to replace the one broken on left-hand fork-rod; 4 gibbs to replace the broken ones; and one set of air-pump valves.

The usual amount of work has been done on both engines, such as cleaning brasses, overhauling pump-valves, and other minor repairs.

Boilers. — The furnaces of all the boilers have been relined.

Feed-pumps. — Both pumps have been repaired, and are in good condition.

Dynamo. — The insulation ring of the commutator burned out was repaired, and is now running.

All the repairs, with the exception of beam of No. 2 Engine, and the dynamo, were done by the regular employees at this station.

East Boston Station. — The roof of the building has been repaired and some pointing done outside. To make a bedroom, a partition was put up inside, which was stained and varnished, together with the window-frames and sashes. The pumps and boilers are in good condition.

West Roxbury Station. — Owing to numerous complaints from the water-takers on this service of a continual noise while the pump is at work, an air-chamber has been put in at the pump, which has greatly relieved the trouble. The pump and boilers have had their regular attention.

Elmwood-street Station. — This building was vacated by the department some time since. As the work formerly

done there is now done at the Chestnut-hill Pumping-station, and as this building can be put to no practical use by this department, authority has been asked from the City Government to sell the premises.

The stand-pipes at Mt. Bellevue, West Roxbury, and Orient Heights, East Boston, are in good condition.

Pipe Yard and Buildings. — The machine-shop, which was built last year, is in good condition.

The stable, which is also new, is in good condition, and is now heated by steam supplied from the machine-shop, which does away with the danger from an overheated stove. I would recommend that the old shed on the north side of the yard be torn down, and a 2-story brick building be erected in its stead, to be used for the storage of wagons, sleighs, cement, and other material.

DISTRICT STABLES.

East Boston. — The old pumping-station has been remodelled and is now used as a stable and workshop for this district. The work was done by the department.

Dorchester. — A new 1½-story wooden stable is being erected on Gibson street for this district, and when completed will have stalls for 4 horses, a large wagon-room, and also 3 small rooms to be used as a headquarters for the men.

West Roxbury. — The building owned by A. H. Tompkins, now occupied as a stable and headquarters, is altogether inadequate for the needs of this district. I recommend that a site be selected in the vicinity of South and Centre streets, and a building, to be used as a stable and workshop, be erected as soon as possible.

Brighton. — The stable is in good condition.

RESERVOIRS.

Parker Hill. — The keeper's house has been repaired inside, and the gate-house and grounds are in good condition. This reservoir, which has never been cleaned since it was first filled in 1875, is to be cleaned during the coming season.

East Boston. — A fence 844 feet in length has been rebuilt on the north and east sides. The reservoir and the grounds around it are in good condition.

South Boston. — The reservoir is in good condition, but the fence around it is out of repair and is to be rebuilt.

WASTE DETECTION.

The work of this department has been continued throughout the year.

The force consists of eleven inspectors, ten of whom have been employed the whole year and one since Oct. 19, 1891.

The premises of all water-takers have been examined, and more than 8,000 notices to repair defective fixtures have been issued.

The following table shows the work of the inspectors during the year :

Premises examined	63,700
“ notified to repair defective fixtures	8,735
“ reëxamined	8,661
Second notices to repair issued	325
“ reëxaminations made	753
Wilful waste notices issued	104
Fines collected	2
Defective services in street	120
Hopper water-closets not self-closing, reported	78

The defective fixtures may be divided into the following classes :

Ball-cocks	3,848
Water-closets	2,476
Faucets ; sink, bowl, and bath-tub	3,078
Stopcocks	10
Services burst inside building	439
“ “ outside “ for owner to repair	94
“ “ “ “ city “ “	106
Wilful waste	104

THE DEACON METER SYSTEM.

Cochituate Division. — There are now in use 81 Deacon meters, 74 on the Cochituate system and 7 on the Mystic system. The territory supplied by the meters is divided into 176 sections. The entire residential portion of Boston can now be tested by the meters with the exception of a portion of West Roxbury and that portion of the Back Bay district bounded by Boylston street, Parker street, and the Boston & Providence Railroad.

Mystic Division. — Charlestown is practically covered by meters, one meter supplies a small portion of Somerville, and one about one-quarter of Chelsea. Everett has no meter.

The following statement is condensed from the returns of

the different sections, and shows the daily average consumption and also the rate consumption during the hours of 1 to 4 A.M. at the close of the season of 1890 and the beginning and end of the season of 1891:

	Population.	1890.		1891.			
		2D READING.		1ST READING.		2D READING.	
		Daily consumption.	Night rate.	Daily consumption.	Night rate.	Daily consumption.	Night rate.
		Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.
Cochituate	360,200	47.5	27.6	52.1	31.8	53.7	33.2
Mystic	46,200	35.3	20.0	45.1	27.3	45.2	29.6

METERS.

Cochituate Division. — Three hundred and thirty-four meters have been applied, and 122 have been discontinued, making a net increase of 212, and the total number in service, 3,839.

Mystic Division. — Thirty-nine meters have been applied, 24 have been discontinued, making a net increase of 15 meters, and the total number now in service, 406.

WATER-POSTS.

Eighty-six water-posts have been erected and 5 abandoned, making the number now in use 251.

FOUNTAINS.

Five drinking-fountains have been erected during the past year. The rapid growth of the city and the corresponding increase of travel make it imperative from humane considerations that many special locations be supplied with drinking-fountains. Many of the drinking-fountains now in use are of antique pattern and inconvenient, and should be replaced by those of recent improvement and invention, which may be used by both man and beast.

In the city proper, a drinking-fountain has been erected at the junction of Malden and Wareham streets; the stone foundation of the drinking-fountain at the corner of Boylston and Charles streets has been reset, and the one in Custom-House square was raised.

The old fountain on Broadway, at Independence square, South Boston, has been abandoned, and an ornamental iron drinking-fountain has been erected in its place.

On account of the improvements made in Central and Maverick squares, East Boston, two old stone watering-troughs have been abandoned, and ornamental iron drinking-fountains for beasts only, and furnished with electric-light posts, have been erected in their stead. The drinking-fountain in Belmont square has been abandoned.

On Adams street, corner Minot, Dorchester, a drinking-fountain of modern style for man and beast has taken the place of the old one. The drinking-fountain at the junction of Adams and Neponset avenue has been removed by order of the Board of Aldermen.

The following is a list of fountains now in use :

NOTE. — (†) Indicates a continuous flow of water in warm weather. (*) Automatic fixtures for man and beast in warm weather, and a continuous flow of water for beasts in cold weather. (‡) Continuous flow of water summer and winter. (§) Automatic fixtures for man. (||) Automatic fixtures for man and beast in warm weather only.

City Proper.

No.			
49	Mt. Washington avenue, at drawbridge	.	*
22	Malden street, junction Wareham street	.	*
63	North square	.	§
46	Post-Office square	.	*
33	Tremont street, at Clarendon	.	*
47	Winthrop square	.	*
32	Washington street, at Blackstone square	.	*
39	West Chester park, near Westland avenue	.	*
48	Atlantic avenue, at India wharf	.	*
43	Atlantic avenue, at Rowe's wharf	.	*
42	Atlantic avenue, junction Commercial street	.	*
31	Albany street, opposite Concord	.	*
56	Boston Common	.	§
57	Boston Common	.	§
58	Boston Common	.	§
59	Boston Common	.	§
60	Boston Common	.	§
61	Boston Common	.	§
36	Beacon street, corner Charles	.	*
72	Beacon street, junction Commonwealth avenue	.	†
37	Charles street, opposite the jail	.	*
34	Columbus avenue, opposite Church	.	*
63	Causeway street, at B. & L. R.R. depot	.	§
40	Causeway street, junction Merrimac	.	*
35	Charles street, corner Boylston	.	*
45	Custom-House square	.	†
44	Fort-hill square	.	*
41	Haymarket square	.	*
38	Leverett street, at Cambridge bridge	.	*

East Boston.

No.							
51	Central square . . . . .	.	.	.	.	.	†
52	Bennington street, junction Chelsea . . . . .	.	.	.	.	.	*
50	Maverick square . . . . .	.	.	.	.	.	†
64	Neptune road, at Wood Island park . . . . .	.	.	.	.	.	§
53	Saratoga street, junction Pope . . . . .	.	.	.	.	.	*

South Boston.

28	A street, near First . . . . .	.	.	.	.	.	*
25	Dorchester avenue, junction Boston . . . . .	.	.	.	.	.	*
29	Foundry street, opposite First . . . . .	.	.	.	.	.	||
30	Fourth street, corner Foundry . . . . .	.	.	.	.	.	*
27	Fourth street, corner Dorchester . . . . .	.	.	.	.	.	*
26	Fourth street, junction Emerson . . . . .	.	.	.	.	.	*
68	Independence square . . . . .	.	.	.	.	.	*
69	Q street, near Fifth . . . . .	.	.	.	.	.	*
70	Sixth street, near P . . . . .	.	.	.	.	.	§
71	Telegraph hill . . . . .	.	.	.	.	.	§

Roxbury.

16	Albany street, junction Dearborn . . . . .	.	.	.	.	.	*
13	Eliot square . . . . .	.	.	.	.	.	†
15	Eustis street, corner Washington . . . . .	.	.	.	.	.	*
6	Heath street, at Tremont . . . . .	.	.	.	.	.	*
12	Pyncheon street, near Roxbury . . . . .	.	.	.	.	.	||
14	Tremont street, junction Cabot . . . . .	.	.	.	.	.	*
66	Westminster street, opposite Williams . . . . .	.	.	.	.	.	*

Dorchester.

54	Adams street, opposite Minot . . . . .	.	.	.	.	.	*
18	Blue Hill avenue, junction Washington . . . . .	.	.	.	.	.	*
17	Blue Hill avenue, opposite Franklin park . . . . .	.	.	.	.	.	||
67	Commercial street, opposite Beach . . . . .	.	.	.	.	.	*
16	Dorchester avenue, junction Adams . . . . .	.	.	.	.	.	*
23	Glover's Corner . . . . .	.	.	.	.	.	*
20	Neponset avenue, opposite Walnut street . . . . .	.	.	.	.	.	*
56	River street, junction Blue Hill avenue . . . . .	.	.	.	.	.	†
24	Upham's Corner . . . . .	.	.	.	.	.	*

West Roxbury.

5	Centre street, junction Day and Perkins streets . . . . .	.	.	.	.	.	*
55	“ “ “ South street . . . . .	.	.	.	.	.	*
1	“ “ “ opposite Spring street . . . . .	.	.	.	.	.	*
3	South street, junction Morton street . . . . .	.	.	.	.	.	||
2	Washington street, junction South street . . . . .	.	.	.	.	.	*
4	“ “ “ near Burnett . . . . .	.	.	.	.	.	*

Brighton.

No.								
11	Barry's Corner . . . . .	.	.	.	.	.	.	*
65	Beacon street, opp. Chestnut-hill Reservoir . . . . .	.	.	.	.	.	.	\$
8	Market street, Cattle Fair Hotel . . . . .	.	.	.	.	.	.	*
10	Union square . . . . .	.	.	.	.	.	.	*
9	Western avenue, Charles-river Hotel . . . . .	.	.	.	.	.	.	*
7	Washington street, at Oak square . . . . .	.	.	.	.	.	.	*

METERS APPLIED.

COCHITUATE.	4"	3'	2"	1½"	1"	¾"	⅝"	Total.
Worthington	1	1	9	17	44	25	3	100
B. W. W. . . . .	.	.	.	.	.	18	.	18
Crown	4	3	6	8	18	23	57	119
Hersey . . . . .	.	1	2	2	11	13	6	35
Metropolitan . . . . .	.	.	.	.	.	59	1	60
Thomson . . . . .	.	.	.	.	.	1	1	2
	5	5	17	27	73	139	68	334

METERS DISCONTINUED.

COCHITUATE.	4	2"	1½"	1"	¾"	⅝"	Total.
Worthington . . . . .	.	2	3	11	11	18	45
Crown	1	.	1	2	3	56	63
Hersey . . . . .	.	.	1	.	1	.	2
B. W. W. . . . .	.	.	.	.	12	.	12
	1	2	5	13	27	74	122

METERS SENT TO FACTORY FOR REPAIRS.

COCHITUATE.	3'	2"	1½"	1"	¾"	⅝"	Total.
Worthington . . . . .	.	8	3	14	1	.	26
Crown	3	2	2	9	16	56	83
Hersey . . . . .	.	.	.	3	7	2	12
Thomson . . . . .	.	.	.	.	.	1	1
	3	10	5	26	24	59	127

METERS PURCHASED.

	4"	3"	2"	1½"	1"	¾"	⅝"	Total.
Worthington	3	3	12	19	21	12	. . .	70
Crown	2	4	8	7	10	32	. . .	63
Hersey . . . . .	. . .	1	3	12	20	17	14	67
Metropolitan . . . . .	. . .	. . .	. . .	. . .	. . .	96	4	100
Champion . . . . .	. . .	. . .	. . .	. . .	. . .	1	. . .	14
Thomson . . . . .	. . .	. . .	. . .	. . .	. . .	4	6	10
	5	8	23	38	51	162	24	311

METERS IN SERVICE JANUARY 31, 1892.

COCHITUATE.	6"	4"	3"	2"		1"	¾"	⅝"	Total.
Worthington	10	24	111	99	561	409	108	1,322
B. W. W.	482	. . .	482
Crown	1	16	29	32	58	204	185	1,206	1,731
Hersey	1	4	13	23	37	73	19	170
Ball & Fitts	2	3	5	10
Metropolitan	93	4	97
Thomson	1	1	1	3	6	12
Frost	1	. . .	1	. . .	2
American Frost	2	. . .	2
Desper	2	3	5
Star	4	. . .	4
Champion	1	. . .	1
Nash	1	1
	1	27	57	157	182	805	1,258	1,352	3,839

METERS IN SERVICE FEB. 1, 1892.

Mystic Department.	6"	4"	3"	2"	1½"	1"	¾"	⅝"	Total.
Worthington . . . . .	...	8	3	33	6	76	56	10	192
Crown	2	5	9	9	2	33	48	89	197
B. W. W. . . . .	...	...	...	...	...	...	2	...	2
Hersey . . . . .	...	1	...	2	2	6	...	...	11
Ball and Fitts . . . . .	...	...	2	1	...	...	1	...	4
	2	14	14	45	10	115	107	99	406

METERS APPLIED.

Mystic Department.	3"	2"	1½"	1"	¾"	⅝"	Total.
Worthington	1	2	1	7	1	...	12
Crown	1	...	...	4	8	7	20
Hersey	1	...	2	3	...	...	6
Ball and Fitts	1	...	...	...	...	...	1
	4	2	3	14	9	7	39

METERS DISCONTINUED.

Mystic Department.	4"	3"	2"	1½"	1"	¾"	⅝"	Total.
Worthington . . . . .	...	...	2	...	2	4	2	10
Crown	1	...	2	...	1	4	2	10
Hersey . . . . .	...	1	...	1	2	...	...	4
	1	1	4	1	5	8	4	24

METERS SENT TO FACTORY FOR REPAIRS.

Mystic Department.	4"	2"	1"	¾"	⅝"	Total.
Worthington . . . . .	...	...	...	3	2	5
Crown	1	1	4	9	7	22
	1	1	4	12	9	27

METERS REPAIRED IN SERVICE.

	Cochituate.	Mystic.
Clock broken	82	29
“ defaced	25	12
Leak at spindle	78	9
“ “ coupling	49	1
“ “ nipple	6	
“ “ body	2	
Stopped by fish		10
Coupling broken		1
Gear stuck	3	
Spindle stuck	2	
Nipple broken		1
	<u>247</u>	<u>63</u>

CAUSES FOR CHANGING METERS.

	Cochituate.	Mystic.
Ordered out for examination	207	62
“ “ “ test	90	11
Injured by frost	15	
“ “ hot water	18	2
“ “ fire	2	
No force	57	4
Leak at spindle	13	1
Enlargement of service	40	5
Filled with rust	30	3
Clock broken	37	4
Gravel in meter	2	1
Lever broken	7	1
Stopped in service	14	7
Leak at packing	9	
Spindle broken	6	1
Gear worn	5	
“ broken	12	3
Clock defaced	7	
Lever detached	1	
Solder in meter	5	
Changed location	2	
Gear out of order	5	
Piston worn	3	1
“ broken	2	
Ratchet “		1
Body “	2	
Disc “	2	
Leak at coupling	2	
	<u>695</u>	<u>107</u>

GENERAL STATEMENT FOR THE YEAR 1891.

	COCHITUATE.		MYSTIC.	
	Meters.	Boxes.	Meters.	Boxes.
In service Jan. 31, 1892	3,839	. . . . .	406	
New set	334	57	39	6
Discontinued	122	. . . . .	24	
Changed	695	. . . . .	107	
Changed location	19	. . . . .	6	
Tested at shop	1,715	. . . . .	149	
Repaired at shop	401	. . . . .	46	
Repaired at factory	127	. . . . .	27	
Repaired in service	247	67	63	41
Purchased	311			

Statement of Location, Size, and Number of Feet of Pipe laid in 1891.

NOTE.—B. indicates Boston; S.B., South Boston; E.B., East Boston; Rox., Roxbury; Dor., Dorchester; W. Rox., West Roxbury; Bri., Brighton.

In what Street.	Between what Streets.	District.	Size.	Length.
Chester sq.	Washington and Shawmut ave.	B.	30	47
“ park	“ “ Harrison ave.	“	“	768
East Chester park . . .	Harrison ave. and Swett	B. and Rox.	“	1,284
Swett	E. Chester park and N. Y. & N. E. R.R.,	Rox.	“	1,899
	Total 30-inch			<u>3,998</u>
Arnold Arboretum . .	Walter and South	W. Rox.	24	2,018
	Total 24-inch			<u>2,818</u>
Congress	A and B	S.B.	16	737
Terrace	Alleghany and New Heath	Rox.	“	120
Huntington ave. . . .	Parker and Longwood ave.	“	“	473
Talbot ave.	Harvard and Bernard	Dor.	“	508
	Total 16-inch			<u>1,838</u>
Aldine	Atlantic ave. and Estes	B.	12	322
Audubon road	Westland and Brookline ave.	“	“	1,073
Gainsborough	Falmouth and Parker	“	“	209
Berkeley	Chandler and Columbus ave.	“	“	154
B	Second and Congress	S.B.	“	2,468
E	“ “ Athens	“	“	442
Byron	Bennington and Homer	E.B.	“	223
Bennington	Saratoga and Ashley	“	“	125
Holborn	Warren and Blue Hill ave.	Rox.	“	258
Magazine	Norfolk ave. and Kemble	“	“	227
Kemble	Magazine and Hampden	“	“	1,276
Gerard	Norfolk ave. and Swett	“	“	1,758
Humboldt ave.	Walnut ave. and Waumbeck	“	“	2,391
E. Chester park	At Albany	B.	“	25
Washington	At Chester park	“	“	6
Lawn	Hayden and Heath	Rox.	“	494
Hayden	Fisher ave. and Lawn	“	“	283
Parker Hill ave. . . .	Parker and Hillside	“	“	494
	Carried forward			<u>12,228</u>

Statement of Location, Size, etc.—Continued.

In what Street.	Between what Streets.	District.	Size.	Length.
	<i>Brought forward</i>			12,228
Shirley	Norfolk ave. and George	Rox.	12	450
Hutchins ave.	From Day	"	"	133
Westville	Geneva ave. and Ditson	Dor.	"	262
Codman	Dorchester ave. and Washington	"	"	218
Magnolia	Quincy and Lawrence ave.	"	"	165
Stockton	Milton ave. and Washington	"	"	118
Morton	N. Y. & N. E. R.R. and Fairmount	"	"	991
Seldon	Morton and Nelson	"	"	35
Homes ave.	Topliffe and Draper	"	"	56
Butler	Bearse and Vose	"	"	241
West Seldon	From Morton	"	"	551
Centre	Washington and Carlisle	"	"	324
Bernard	Talbot ave. and N. Y. & N. E. R.R.	"	"	50
Harvard	Blue Hill ave. and Abbott	"	"	206
Edson	Norfolk and Milton ave.	"	"	64
May	Pond and Centre	W. Rox.	"	64
Dudley ave.	Bellevue ave. and Metcalf	"	"	114
Bellevue ave.	Centre and Cornell	"	"	1,074
Florence	Marion and Harrison	"	"	198
Baker	Gardner and Mt. Vernon	"	"	1,888
La Grange	Jordan and Vale	"	"	419
Centre	Grove and Dedham line	"	"	2,719
Centre	Hewlitt and Arundel	"	"	275
Hewlitt	Centre and Walter	"	"	17
Montclair ave.	Centre and Merlin	"	"	491
New Call	Keyes and Boynton	"	"	175
Western ave.	No. Harvard and Cambridge line	Bri.	"	3,079
Cambridge	Chamberlin " "	"	"	1,241
Sutherland road	Selkirk and Lanark roads	"	"	51
Lake	Kendricken and South	"	"	413
Faneuil	Market and Parson	"	"	190
Warren	Cambridge and Allston	"	"	955
Homes ave.	From No. Harvard	"	"	1,087
Bigelow	Webster and Dunboy	"	"	525
	Total 12-inch			<u>31,367</u>

Statement of Location, Size, etc. — *Continued.*

In what Street.	Between what Streets.	District.	Size.	Length.
Randolph	Albany and Harrison ave.	B.	10	455
Plympton	" " "	"	"	405
Wareham	" " "	"	"	372
Harvest	Boston and Dorchester ave.	Dor.	"	531
Medway	Branch and Bearse	"	"	290
Carruth	Codman and Van Winkle	"	"	539
Tolman	Norwood and Neponset ave.	"	"	136
Centre	South and Church	W. Rox.	"	140
Church	Centre and Weld	"	"	1,239
Brook	Hill and Bellevue ave.	"	"	689
Royal road	Cambridge and Coolidge road	Bri.	"	923
Murdock	Hill and Spring	"	"	652
	Total 10-inch			<u>6,371</u>
Boylston	West Chester Park and B. & A. R.R.	B.	8	366
Malden	Wareham and Albany	"	"	786
Hathaway	Congress and Summer	"	"	485
Reed	Thorndike and Walnut place	"	"	613
Thorndike	Reed and Washington	"	"	177
State	At Merchants row	"	"	6
Merchants row	State and Chatham	"	"	50
Alger	Dorchester ave. and Dorchester	S.B.	"	1,056
Washington	At Essex	B.	"	12
Washburn	Dorchester ave. and Boston	S.B.	"	557
East Ninth	Old Harbor and G	"	"	159
Preble	Wendall and Vinton	"	"	169
Vinton	Preble and Dorchester	"	"	666
Gladstone	From Breed	E.B.	"	189
Fulda	Highland and Valentine	Rox.	"	332
Calumet	Hillside and Pequot	"	"	924
Harrishoff	Humboldt ave. and Harold	"	"	52
Holland	" " " "	"	"	48
Gay Head	Minden and Centre	"	"	236
Kingsbury	Washington and Grainger	"	"	234
Heath	Lawn and Tremont	"	"	113
Dimock	Amory and Washington	"	"	249
	<i>Carried forward</i>			<u>7,479</u>

Statement of Location, Size, etc. — *Continued.*

In what Street.	Between what Streets.	District.	Size.	Length.
	<i>Brought forward</i>			7,479
Round Hill	Day and Gay Head	Rox.	8	318
King	Queen and Adams	Dor.	"	829
Train	King and Boutwell ave.	"	"	215
Welles ave.	Ocean and Argyle	"	"	59
Bearse	From Crest ave.	"	"	877
Rosemont	" Adams	"	"	403
Rosemont terrace . . .	" Rosemont	"	"	160
Julian ave.	Judson and Howard ave.	"	"	408
Melbourne	Centre and Welles ave.	"	"	162
Kilton	Park and Harvard	"	"	174
Street off Carruth . .	Carruth and O. C. R.R.	"	"	33
Pierce ave.	Adams and Newhall	"	"	617
Norfolk	Walkhill and N. Y. and N. E. R.R. . . .	"	"	238
Street	From Norfolk	"	"	133
Algonquin	Washington and Harvard	"	"	964
Elizabeth	Norfolk and Astoria	"	"	329
Astoria	Elizabeth and Flint	"	"	105
Fuller	Morton and Capen	"	"	304
Street off King	King and Rosemont	"	"	254
Bowdoin ave.	Hawes ave. and Morse	"	"	204
Brookford	Dromey and Howard aves.	"	"	170
Duncan	Granger and Leonard	"	"	126
Seaborn	Centre and Kenwood	"	"	322
Fenton	Duncan and Fenton pl.	"	"	172
Northern ave.	Whitfield and Washington	"	"	256
Templeton	From Adams	"	"	196
Landseer	Bellevue and La Grange	W. Rox.	"	299
Walter	Symmes and Weld	"	"	997
Harrison	Florence and O. C. R.R.	"	"	532
Baker pl.	From Baker	"	"	33
Cornell	Orange and Hill	"	"	496
Mendum	Walter and Fairview	"	"	259
Fairview	Proctor and Mendum	"	"	344
Kittredge	Norfolk and Metropolitan ave.	"	"	48
	<i>Carried forward</i>			18,515

Statement of Location, Size, etc. — Continued.

In what Street.	Between what Streets.	District.	Size.	Length.
	<i>Brought forward</i>			18,515
Temple	Ivory and O. C. R.R.	W. Rox.	8	98
Charles	Kittredge and Poplar	"	"	207
Kittredge	James and Charles	"	"	311
Brookside ave.	Green and Germania	"	"	811
Bellevue	Coruell and Hemlock	"	"	312
Weldon	From Wenham	"	"	272
Arlington	Market and Arlington pl.	Bri.	"	357
Lanark road	Kilsyth and Sunderland roads	"	"	899
Coolidge road	Mansfield and No. Harvard	"	"	976
Aldie	Franklin and Athol	"	"	131
Summit ave.	Allston and Sumner	"	"	110
Bradbury	Franklin and Mansfield	"	"	206
Murdock	Whitney and Hill	"	"	248
Mt. Vernon	Foster and Rockland	"	"	340
Windom	Home ave. and Cambridge	"	"	760
Dustin	Cambridge and No. Harvard	"	"	490
Holland road	No. Harvard and Royal Road	"	"	942
	Total 8-inch			25,985
Chandler	Berkeley and Tremont	B.	6	156
Cobb	Washington and Shawmut ave.	"	"	269
Haviland	W. Chester park and Parker st.	"	"	323
Harcourt	St. Botolph and O. C. R.R.	"	"	271
E. Lenox	Reed and Washington	"	"	7
Newcomb	" " "	"	"	22
Pinckney	Louisburg sq. and Cedar	"	"	7
Walnut pl.	Reed and Washington	"	"	95
McLellan	From Reed	"	"	152
Albemarle	St. Botolph and O. C. R.R.	"	"	253
East Ninth	K and N	S.B.	"	1,101
Cottage	E. Ninth and O. C. R.R.	"	"	164
Tudor	D and E	"	"	163
Monks	E. Sixth and E. Seventh	"	"	297
Bolton	At E.	"	"	55
Old Harbor	Elighth aud Ninth	"	"	76
	<i>Carried forward</i>			3,411

Statement of Location, Size, etc.—Continued.

In what Street.	Between what Streets.	District.	Size.	Length.
	<i>Brought forward</i>			3,411
Hall pl.	From E. Fifth	S.B.	6	146
Sleeper	Congress and N. Y. & N. E. R.R. . . .	"	"	60
Cowper	Wordsworth and the water	E.B.	"	147
Pope	Byron and Moore	"	"	72
Collins	From Bayswater	"	"	79
Terrace pl.	Webster and Webster	"	"	131
Falcon	Brooks and Putnam	"	"	60
Homer	Moore and Byron	"	"	102
Terrace	Alleghany and N. Heath	Rox.	"	30
Schiller	Heath and Mansur	"	"	102
Perch	From Pike	"	"	142
Pike	Albany and Perch	"	"	121
Putnam pl.	From Roxbury	"	"	181
Forbes	Centre and Chestnut ave.	"	"	366
Ingleside	Dacia and Blue Hill ave.	"	"	248
Holiworthy	Walnut and Humboldt aves.	"	"	45
Hamerton	Humboldt ave. and Harold	"	"	48
Grainger	Elmore and Kingsbury	"	"	228
Dalmatia	Blue Hill and Howard aves.	"	"	131
Bickford	Centre and Bromley park	"	"	333
Duncan	From Ruggles	"	"	200
Sunnyside terrace . .	Centre and Creighton	"	"	322
Hawthorne ave. . . .	From Washington	"	"	234
Binney	Longwood ave. and Smyrna	"	"	127
Smyrna	Binney and Brookline ave.	"	"	55
Smith	Whitney and Worthington	"	"	104
Dromey ave.	From Brookford	"	"	63
Dakota	Holborn and Gaston	"	"	493
Oregon	Conant and Smith	"	"	128
Cobden	Walnut ave. and Washington	"	"	254
Grotto glen	From Day	"	"	30
Street	" Amory	"	"	414
Conant pl.	" Conant	"	"	137
Howland	" Humboldt ave.	"	"	238
	<i>Carried forward</i>			8,982

Statement of Location, Size, etc. — *Continued.*

In what Street.	Between what Streets.	District.	Size.	Length.
	<i>Brought forward</i>			8,982
Marshfield	Norfolk ave. and Batchelder	Rox.	6	237
Moreland terrace . . .	Blue Hill ave. and Dennis	"	"	42
Johnson ave.	Buckley ave. and Centre	"	"	148
Buckley ave.	From Johnson ave.	"	"	83
Wyoming	Warren and Webano	"	"	36
Heath ave.	Heath pl. and Heath	"	"	48
Edgehill	Round Hill and Gay Head	"	"	625
Gaston	Blue Hill and Dakota aves.	"	"	190
Gurney	Tremont and Parker	"	"	36
St. Mary	Commonwealth ave. and B. & A. R.R. .	"	"	217
Blackwell	Neponset ave. and Bowman	Dor.	"	97
Dndley	Monadnock and Nonquit	"	"	189
Pleasant pl.	From Savin Hill ave.	"	"	91
Brent	Washington and Carlisle	"	"	190
Grauville pl.	From Dean ave.	"	"	87
Eaton	" Tolman	"	"	64
Street	" New Minot	"	"	212
Birch	Chapman ave. and Oak terrace	"	"	52
Oak terrace	Birch and Lyons	"	"	491
Cunningham	Howard ave. and Magnolia	"	"	235
Oleander	Bird and Alexander ave.	"	"	262
Josephine	Geneva ave. and Ditson	"	"	257
Corbett	Morton and Evans	"	"	117
Chapman ave.	Tucker and Lauriat ave.	"	"	108
Vose	Butler and Crest	"	"	435
Evans	Corbett and Morton	"	"	263
Hopkins	Evans and Corbett	"	"	44
Faulkner	Freeman and Trowbridge court	"	"	166
Freeman	Faulkner and Charles	"	"	17
Elmont	From Waterlow	"	"	80
Street	" Ballou ave.	"	"	106
Baker pl.	" Washington	"	"	6
Rill	" Ware	"	"	42
Street	" Carruth	"	"	33
	<i>Carried forward</i>			14,288

Statement of Location, Size, etc. — *Continued.*

In what Street.	Between what Streets.	District.	Size.	Length.
	<i>Brought forward</i>			14,288
Wrentham	Dorchester ave. and Ashmont	Dor.	6	411
Elton	“ “ “ Sagamore	“	“	226
Albert pl.	From Adams	“	“	171
Street	“ Norfolk	“	“	138
Lyndhurst	Allston and Washington	“	“	604
Bowdoin sq.	Dakota and Westville ave.	“	“	142
Dakota	Geneva ave. and Bowdoin sq.	“	“	24
Leroy	“ “ “ Ditson	“	“	105
Branch	Medway and Butler	“	“	232
Bradlee	Algonquin and School	“	“	690
Mt. Everett	Barrington and Quiney	“	“	68
Neponset ave.	King and Boutwell ave.	“	“	603
Whitfield	Wheatland and Northern aves.	“	“	90
Sewell	From Neponset ave.	“	“	176
Dalmatia	Howard and Blue Hill aves.	“	“	395
Percival ave.	Fox and Church	“	“	253
Tileston	Blue Hill ave. and Walkhill	“	“	701
Clarkson	Quiney and Barrington	“	“	48
Wheatland ave.	Kilton and N. Y. & N. E. R.R.	“	“	44
Auckland	Elton and Belfort	“	“	135
Buttonwood	Vernon and Locust	“	“	412
Street	From Magnolia	“	“	218
Hawes ave.	Bowdoin ave. and Washington	“	“	230
Grace ave.	Arcadia and Robinson	“	“	155
Carson	Mt. Vernon and the water	“	“	203
Norwood	From Tolman	“	“	441
Folsom	Dudley and Harlow	“	“	169
Tremlet park	Hooper and Waldeck	“	“	974
Shawmut park	King and Rosemont	“	“	241
White	From McClellan	“	“	68
Judson	W. Cottage and Julian ave.	“	“	170
Leeds	From Savin Hill ave.	“	“	65
Bowman	Blackwell and Chickatawbut	“	“	174
Granger	Clayton and Duncan	“	“	48
	<i>Carried forward</i>			23,112

Statement of Location, Size, etc. — *Continued.*

In what Street.	Between what Streets.	District.	Size.	Length.
	<i>Brought forward</i>			23,112
Arundel	From Beaumont	Dor.	6	413
Arcadia court	From Dorchester ave.	"	"	334
Morse	Bowdoin ave. and Washington	"	"	54
Hillside terrace	Bailey and Fuller	"	"	126
Fenton pl.	Fenton and Greenwich	"	"	81
Howe	From Hancock	"	"	206
Ballard way	" Jamaica	W. Rox.	"	98
Jackson pl.	" Washington	"	"	234
Huntington ave.	Canterbury and Hyde Park line	"	"	339
Robert	Brookfield and So. Walter	"	"	190
Prospect ave.	Sheldon and Sycamore	"	"	116
Keyes	Mechan and Forest Hills	"	"	470
Street	From Weldon	"	"	150
Buchanan court	" South	"	"	114
Street	" Gardner	"	"	13
Street	" Union ave.	"	"	146
Abbott	" Willow	"	"	201
Ashfield	Walter and Fairview	"	"	367
Myers	From Spruce	"	"	197
Brook	Florence and Sycamore	"	"	87
Cornell	Roslindale and Orange	"	"	257
Atherton ave.	Washington and Albano	"	"	173
Bradstreet	From Mt. Hope	"	"	153
Clifton	Albano and Norfolk	"	"	476
James	Kittredge and Poplar	"	"	362
So. Fairview	Brookfield and So. Walter	"	"	96
Plainsfield	Keyes and Williams	"	"	178
Ballard pl.	From Ballard	"	"	30
Henshaw	" Centre	"	"	370
Pomfret	Corey and Maple	"	"	260
Cornwall	Brookside ave. and Stony Brook	"	"	197
Paul Gore	Lamartine and Danforth	"	"	139
Wenham	Hyde Park ave. and Yale	"	"	116
Ballard	Centre and Custer	"	"	173
	<i>Carried forward</i>			30,023

Statement of Location, Size, etc. — *Continued.*

In what Street.	Between what Streets.	District.	Size.	Length.
	<i>Brought forward</i>			30,028
Metcalf	From Dudley	W. Rox.	6	174
Jones	Fairview and Walter	"	"	365
Custer	From Goldsmith	"	"	96
Rockview pl.	" Rockview	"	"	196
Maxfield	Bellevue and La Grange	"	"	219
Egleston	Boylston and School	"	"	36
Paul Gore	Centre and Chestnut ave.	"	"	209
Arundel	Walter and Centre	"	"	482
Starr lane	Centre and Seaverns ave.	"	"	48
Metropolitan ave.	From Washington	"	"	62
Woodside	" Burroughs	"	"	264
Lexington ave.	Washington and Union	Bri.	"	96
Webster	From Cambridge	"	"	270
Grant ave.	" Wilton	"	"	183
Rena	North Harvard and Hubbard	"	"	181
Mansfield	Bradbury and Eaton	"	"	188
Madison ave.	Washington and Union	"	"	164
Wadsworth	Ashford and Pratt	"	"	347
Silkirk road	Sutherland and Kilsyth roads	"	"	123
Seattle	Home ave. and Cambridge	"	"	238
Almy	Windom and Seattle	"	"	192
Sorrento	Cambridge and Home ave.	"	"	275
Kenneth	Franklin and Bayard	"	"	212
Bayard	Kenneth and Weitz	"	"	224
Harriet	From Parson	"	"	495
Kilsyth road	Lanark and Lanark road	"	"	495
Chiswick road	Silkirk road and Commonwealth ave.	"	"	341
Dunboy	Hugh and Faneuil	"	"	140
Hollis pl.	From Allston	"	"	31
Haskell road	Coolidge and Holland roads	"	"	616
Richardson	From Western ave.	"	"	119
Andrew road	Coolidge and Holland roads	"	"	573
Homer road	" " " "	"	"	508
	Total 6-inch			38,190

Statement of Location, Size, etc.— *Concluded.*

In what Street.	Between what Streets.	District.	Size.	Length.
Winter pl.	From Winter	B.	4	108
Haymarket pl.	Avery and Bumstead court	"	"	44
K-street pl.	From K	S.B.	"	123
Street	" Third	"	"	114
Cherry court	" Cherry	Rox.	"	209
Dana court	" Dana	"	"	45
Clayton pl.	" Clayton	Dor.	"	147
Street	" Oakdale	W. Rox.	"	130
Street	" Chestnut ave.	"	"	116
Brookside ave.	Green and Cornwall	"	"	220
Morgan pl.	From Grover	"	"	155
	Total 4-inch			1,411
Total number feet laid			30	3,998
" " " "			24	2,018
" " " "			16	1,838
" " " "			12	31,367
" " " "			10	6,371
" " " "			8	25,985
" " " "			6	38,190
" " " "			4	1,411
" " " "				111,178

**Statement of Location, Size, and Number of Feet of Pipe
Relaid and Abandoned in 1891.**

In what Street.	Between what Streets.	District.	Size.	Length Abandoned.	Size of Pipe as Relaid.
Berkeley	Chandler and Columbus ave.	B.	12	154	12
Harvard	Blue Hill ave. and Abbott	Dor.	12	206	12
	Total 12-inch	"	. . .	<u>360</u>	
Randolph	Albany and Harrison ave.	B.	6	445	10
Plympton	" " " "	"	"	405	10
Wareham	" " " "	"	"	372	10
Malden	" " Wareham	"	"	786	8
Fourth	Q and the park	S.B.	"	194	0
E	Second and Athens	"	"	442	12
Vinton	Preble and Dorchester	"	"	107	8
B	First and Second	"	"	273	12
Downer	From Tremont	Rox.	"	758	0
St. Mary	Commonwealth ave. and B. & A. R.R. .	"	"	141	6
Baker pl.	From Bird	Dor.	"	60	0
	Total 6-inch . . . . .	. . .	. . .	<u>3,983</u>	
Winter pl.	From Winter	B.	4	108	4
Tudor	D and E	S.B.	"	163	6
Bolton	At E	"	"	55	6
Vinton	Preble and Dorchester	"	"	559	8
Forbes	From Chestnut ave.	W.R.	"	30	6
	Total 4-inch . . . . .	. . .	. . .	<u>915</u>	
			Lead.		
St. Mary	Commonwealth ave. and B. & A. R.R. .	Rox.	1½	86	6

Statement of Pipes Lowered.

In what Street.	Between what Streets.	District.	Size.	Length.
Dudley	At Hampden	Rox.	24	100
	Total 24-inch			100
Munroe	Humboldt ave. and Hazelwood	"	12	295
	Total 12-inch			295
Symmes	From Walter	W.R.	8	400
	Total 8-inch			400
Seattle	Cambridge and Home ave.	Bri.	6	300
Dunboy	Bigelow and High	"	6	268
	Total 6-inch			568

Raised.

Sturbridge	Sandford and River	Dor.	6	631
	Total 6-inch			631

Table showing the Length of Supply and Distribution Mains laid during the Year 1891, and the Length connected with the Sudbury and Cochituate Works, February 1, 1892.

DIAMETER OF PIPES IN INCHES.															Totals.
	60	48	40	36	30	28	24	20	16	12	10	8	6	4	
EASTERN DIVISION.															
Length in use Jan. 1, 1891		25,571	23,054	20,844	53,551	244	55,841	59,484	68,038	744,898	37,452	288,215	1,106,201	126,428	2,609,821
Stopcocks in same			7	12	22		47	36	95	1,122	44	539	2,846	625	5,396
Length laid or relaid during the year					3,998		2,018		1,898	31,367	6,371	25,985	38,190	1,411	111,178
Stopcocks in same					1				5	49	12	60	149	14	290
Length abandoned during the year										360			3,983	915	5,258
Stopcocks in same													9	2	11
Length in use Feb. 1, 1892		25,571	23,054	20,844	57,549	244	57,859	59,484	69,876	775,905	43,823	314,206	1,140,408	126,924	2,715,741
Stopcocks in same		1	7	12	23		47	36	100	1,171	56	599	2,986	637	5,675
WESTERN DIVISION.															
Length in use Feb. 1, 1892	266	16,051	1,435	1,166	2,140				20	2,043			360		23,481
Stopcocks in same		5		3					2	4			2		16
Total connected with the works Feb. 1, 1892	266	41,622	24,489	22,010	59,689	244	57,859	59,484	69,896	777,948	43,823	314,200	1,140,768	126,924	2,739,222, or 518.79 miles.

Statement of Hydrants, Blow-off and Reservoir Pipes, Feb. 1, 1892.

	DIAMETER IN INCHES.					Totals.
	16	12	9	8	6	4
Total length in use Jan. 1, 1891	272	6,883	3,056	28	13,368	11,064
Length laid or relaid during the year . . . . .	.....	8	.....	.....	1,827	.....
Length abandoned during the year . . . . .	.....	19	12	.....	70	186
Total length in use Feb. 1, 1892	272	6,872	3,044	28	15,125	10,878
						36,219

Three hundred and twenty-seven hydrants have been established and eighty abandoned during the year 1891.

	ESTABLISHED.					ABANDONED.					Net Increase.
	Lowry.	Post.	Boston Lowry.	Boston.	Total.	Lowry.	Post.	Boston Lowry.	Boston.	Total.	
Boston	8	15	5	..	28	1	..	4	9	14	14
South Boston	11	10	4	..	25	..	..	1	9	10	15
East Boston	1	2	1	..	4	..	..	1	..	1	3
Roxbury	10	29	15	1	55	6	1	4	6	17	38
Dorchester	4	65	27	..	96	2	..	12	6	20	76
West Roxbury	1	37	14	..	52	..	..	7	2	9	43
Brighton	7	44	16	..	67	..	..	7	2	9	58
	42	202	82	1	327	9	1	36	34	80	247

Hydrants taken and repaired	219
Hydrant-boxes renewed	202
Gate-boxes renewed	248
Deacon meter-boxes renewed	5

Total Number of Hydrants in use Feb. 1, 1891.

	Lowry.	Post.	Boston Lowry.	Boston Y.	Boston.	Total.
Boston	671	218	69	..	524	1,482
South Boston	211	84	20	1	265	581
East Boston	138	80	24	..	138	380
Roxbury	668	146	63	..	101	978
Dorchester	574	302	179	..	76	1,131
West Roxbury	114	371	161	..	51	697
Brighton	73	246	59	..	36	414
Deer Island . . . . .	..	16	..	..	..	16
Brookline	5	..	..	..	3	8
Chelsea . . . . .	..	..	..	..	7	7
Quincy . . . . .	..	7	..	..	..	7
Long Island . . . . .	..	4	..	..	..	4
	2,451	1,474	575	1	1,201	5,705

Repairs of Pipes during the Year 1891.

	Diameter of Pipes in Inches.																	Total.
	40	36	30	24	20	16	12	10	8	6	4	3	2	1½	1¼	1	¾	
Boston	2	3	5		7	7	23	1	5	41	22	2	14	5	1	13	9	312
South Boston					2		2			10	3		4				70	8
East Boston					11	2	8		4	1		2	1		3	1	52	1
Roxbury				1	2		3		2	5	3	1	6	1	1	1	133	1
Dorchester							3			8			2		1	1	51	1
West Roxbury							2			1			6			5	30	
Brighton							1			1							14	
Newton Lower Falls	2																	
Deer Island									1									
	4	3	5	1	22	9	42	1	8	70	29	3	34	7	3	18	15	662
																		16
																		952

Causes of leaks that have occurred in pipes of 4 inches diameter and upwards :

Settling of earth	20	
Blasting	1	
Defective joints	103	
“ pipes	10	
“ stopcocks	5	
“ packing	48	
“ stuffing-box	6	
“ clamps	1	
	—	194
Of 3-inch and in service-pipes :		
Settling of earth	189	
Gnawed by rats	14	
Defective joints	20	
“ packing	7	
“ coupling	17	
“ stopcocks	45	
“ pipes	111	
“ uprights	48	
“ valves	17	
Plug loose	1	
Struck by pick	60	
	—	—
Carried forward	529	194

WATER-SUPPLY DEPARTMENT.

53

<i>Brought forward</i>	.	.	.	.	529	194
Drilling	.	.	.	.	1	
Eaten by soil	.	.	.	.	9	
Fire	.	.	.	.	1	
Broken by steam-roller	.	.	.	.	6	
In way of sewer	.	.	.	.	33	
					<hr/>	579
Stoppage by						
Dirt	.	.	.	.	32	
Gasket	.	.	.	.	8	
Fish	.	.	.	.	6	
Rust	.	.	.	.	116	
Frost	.	.	.	.	17	
					<hr/>	179
Total	.	.	.	.	.	<hr/><hr/>952

Statement of Leaks and Stoppages, 1850-1891.

YEAR.	DIAMETER.		Total.
	Four inches and upwards.	Less than four inches.	
1850	32	72	104
1851	64	173	237
1852	82	241	323
1853	85	260	345
1854	74	280	354
1855	75	219	294
1856	75	232	307
1857	85	278	363
1858	77	234	401
1859	82	449	531
1860	134	458	592
1861	109	399	508
1862	117	373	490
1863	97	397	494
1864	95	594	489
1865	111	496	607
1866	139	536	675
1867	122	487	609
1868	82	449	531
1869	82	407	489
1870	157	707	926
1871	185	1,380	1,565
1872	188	1,459	1,647
1873	153	1,076	1,229
1874	434	2,160	2,554
1875	208	725	928
1876	214	734	948
1877	109	801	910
1878	213	1,024	1,237
1879	211	995	1,206
1880	135	929	1,064
1881	145	883	1,028
1882	170	1,248	1,418
1883	171	782	953
1884	253	1,127	1,380

Statement of Leaks and Stoppages, 1850-1891. — *Concluded.*

YEAR.	DIAMETER.		Total.
	Four inches and upwards.	Less than four inches.	
1855	111	638	749
1886	150	725	875
1887	172	869	1,040
1888	216	1,140	1,356
1889	183	849	1,032
1890	180	718	898
1891	179	758	952

Respectfully submitted,

WILLIAM J. WELCH,
Superintendent Eastern Division.

REPORT OF THE RESIDENT ENGINEER AND SUPERINTENDENT OF THE WESTERN DIVI- SION.

SOUTH FRAMINGHAM, Jan. 1, 1892.

ROBERT GRANT, Esq., *Chairman Boston Water Board:*

SIR: The annual report of the Western Division of the Boston Water-Works is submitted herewith.

SUDBURY-RIVER BASINS.

Water-shed, 75.2 square miles.

The rainfall in 1891 was 49.21 inches, about 1.21 inches more than the average. The quantity of water has been abundant and the quality has been excellent. The rainfall for the last four months of the year was deficient, and the streams in consequence ran low and caused general alarm, but the drought was by no means protracted or severe.

A notable improvement has been completed at the outlet of Basin 4, and a large temporary weir twenty feet in width erected at the outlet of Lake Cochituate, to measure the water passing over the new dam.

A self-recording rain-gauge has been established at Cordaville, very nearly in the centre of the Sudbury-river watershed.

Many surveys have been made on different portions of the work for expected improvements in the way of taking land upon the borders of the brooks and regulating the swamps.

An extension to the old office at South Framingham was begun in November, and a new office built for the pollution department.

During the latter part of the autumn and early winter Basin 4 could not be called upon to supply the city, owing to the work going on at the outlet. Very careful studies have been made of the condition of the water in the various sources. The temperature and the number of the organisms have been recorded at the surface, mid-depth, and bottom of all the basins.

The construction of Basin 6 has been carried on during the season. A large amount of the stripping has been done

and the foundations of the core-wall have been back-filled to the surface of the ground and the earth embankment started. A dredging-plant has been built upon Whitehall pond.

Basin 1.

Grades, H. W., 161.00; Stone crest, 157.54.

Area, 149 acres; Greatest depth, 14 feet; Contents, 288,000,000 gallons.

On Jan. 1, 1891, this basin stood at elevation 157.66 above tide-marsh level in Boston, and water was wasting over the stone crest, and continued to waste until May 11, when both sets of stop-planks were put in place, and the water rose. On May 17 waste over the flash-boards began and continued, with the exception of May 28-30 and June 14-20, until July 3, when the supply for the city was drawn for a few days from this basin. The level fell to 157.07 on July 6. On September 8 the water rose to 158.07, and afterwards fell to 157.00, on November 9. The basin remained nearly at this elevation for the rest of the year.

Both sets of flash-boards were removed on October 31. The highest elevation reached during the year was 159.70, on January 12, and the lowest, 156.83, on November 22.

No water has been drawn from this source for the supply of the city, with the exception of the days already referred to.

The work of removing the gravel ridge from the bed of the river just below Winter street was resumed this year and completed. Some fencing has been removed around the basin, but with this exception no repairs or alterations of importance have been begun. The 48-inch main in the bottom of Basin 1 is in poor condition. I renew my recommendations of last year, that studies should be made during the coming year to put this basin in as good condition as Basins 2, 3, and 4 by removing the shallow flowage, and repairing the pipe-line, with a view to using the basin in the future for an additional settling basin.

A daily flow of at least one and one-half millions of gallons has been passed into the river below the dam, in accordance with the law.

On Aug. 13, 1891, a careful biological and chemical examination was made of the water in Basin 1, it having stood for some time without much circulation. Five different places were taken. The average temperature of the water at the surface was 78.7°, from two to three degrees higher than the surfaces of Basins 2 and 3 at the same time. The color at the surface was from 0.50 to 0.60, somewhat lower than the other basins. The organisms averaged approximately

300 to the cc., both at the surface and bottom, but the amorphous matter at the bottom was high, 1584.0 to the cc. Protococcus was the most numerous of the organisms. Chemical analyses made at the same time showed nothing unusual. The water was of normal quality.

Basin 2.

Grades, H. W., 168.00; Stone crest, 165.87.

Area, 137 acres; Greatest depth, 17 feet; Contents, 530,000,000 gallons.

On Jan. 1, 1891, the surface of the water in this basin was at elevation 165.96, and water was flowing over the stone crest. It continued to overflow until May 9, when both sets of flash-boards were put in place. On May 13 water flowed over the flash-boards, and so continued until May 22, with the exception of May 15 and 16. The basin gradually fell to 157.64 on August 19, and remained at some point between 158.00 and 162.00 until December 8. During the remainder of the year, the level varied from 161.00 to 164.00. October 3 both sets of flash-boards were removed. The highest point reached during the year was 167.27, on May 18, and the lowest, 157.64, August 19.

Water for the supply of the city was drawn wholly from this source from May 16 to May 25, May 28 to June 11, June 14 to July 2, July 6 to August 19, September 15 to September 25, December 1 to December 2, and from Dec. 19 to date. The supply was drawn partially from this basin and partially from Basin 3, from January 1 to May 16, May 25 to May 28, June 11 to June 14, August 19 to September 15, September 25 to December 1, and from December 2 to December 19.

Seven hundred sixty-eight feet of old fence have been removed at the head of this basin, near Fountain street, and a new fence built and other portions of the old fence repaired. The gate-house, gates, dam, and other structures have been maintained in good condition during the year.

The number of organisms has been greater this year in Basin 2 than last year. The general mean at the surface has been about 322 to the cc., and the amorphous matter about the same, viz., 338. The color of the water at the surface has averaged 0.78 on the Nessler scale. Until May the organisms were low in Basin 2, then Synedra and Cyclotella appeared, and throughout the summer increased, but never rose much above 1,000 to the cc., well inside the danger-line. Chlorophyceæ was also present. During the dry season, when the water was low, the organisms were unusually abundant. The experience of weekly examinations for two years has shown us that the predominant organisms

in Basin 2 are *Synedra*, *Cyclotella*, and *Protococcus*, and that the number of organisms per cc. is likely to rise to 500 *Synedra*, 150 *Cyclotella*, and 75 *Protococcus*.

During 1891, 45 observations have been made on the color of the influent water at the head of Basin 2, and it has been found to be usually 1.00. The lowest color observed was 0.32, and the highest 1.80.

Basin 3.

Grades, H. W., 177.00; Stone crest, 175.24.

Area, 283 acres; Greatest depth, 21 feet; Contents, 1,081,000,000 gallons.

On Jan. 1, 1891, this basin stood at elevation 175.32, and water was flowing over the stone crest, and continued to waste either over the crest or through the gates until August 12, with the exception of the following days: January 27-29, February 4-8, 11-16, March 25, 26, 31 to April 1, May 2, 3, 8-12, 15-17, 27-30, June 14-17, and on July 28. After August 12 the surface fell gradually to 162.32 on November 24. From this time it rose quite steadily to 166.93, on December 31. The highest point reached during the year was 176.30, on January 12, and the lowest, 162.32, November 24.

Water for the supply of the city has been at no time drawn solely from this basin, but the storage was drawn upon after August 12 during the whole of the autumn, and the surface was drawn down about 13 feet. The dates on which the supply was taken partly from this basin, and partly from Basin 2, have already been given.

Until the last of April there were very few organisms in Basin 3. At this time there was a short but vigorous growth of *Synedra* and *Tabellaria*. *Chlorophyceæ* appeared in May and *Cyanophyceæ* in June, and until December they were both more or less numerous. From the middle of June to the middle of September the bottom was stagnant, and when this water had been brought into circulation, by the drawing down of the surface, and thus allowing the influence of the wind to be felt, there was a great increase in *Asterionella* and *Protococcus*. By the end of the year the organisms were again few in number. During the last part of April the color at the bottom of this basin began to increase from 0.65 to 2.40, on July 14, and, at the same time, the Amorphous matter increased from 150 to the cc. to about 6,000. A distinctly bad taste was noticeable in July, near the bottom, but, fortunately, we are not obliged to draw the supply in the summer from any other point than the surface.

The effect of drawing down the basin was particularly noticed in November. Last year the basin was only lowered 3.75 feet below the crest, and this was in the spring of the year. During the summer and autumn of 1890 the basin was practically full, and the organisms at no time rose above a monthly average of 325 at the surface, while in November, 1891, they rose to an average of 1,020 at the surface, and practically the same all the way to the bottom.

The advantage of having another large storage basin above Basin 3, to modify the character of the influent, will be very great. Surveys for this much-needed improvement have been begun and are in progress. Plans are also under way for a filter basin, which is much needed for the Marlboro' brook.

In last year's report I referred to the sudden increase of color observed in bottom samples after they were brought to the surface. On Aug. 1, 1891, the following observations were made on samples taken from the old river-bed in the bottom of the basin. The layer of dark water was found to be 3 feet deep. The color of the sample from the bottom when taken was 1.30. In five minutes after taking it was 1.60; ten minutes, 1.80; fifteen minutes, 1.90; thirty minutes, 2.20; two hours, 2.23; two days, 3.50. A sample taken three feet above the bottom was 1.20 when taken, 1.30 at the end of ten minutes, 1.40 at the end of a half-hour, and 1.80 at the end of two days.

The following table, the result of two years' observations, gives the prevailing organisms in Basin 3, together with the number per cc., which they are liable to reach.

500	Asterionella.	100	Cœlospherium.
250	Protoeoccus.	100	Tabellaria.
250	Synedra.	50	Cyclotella.
150	Chroococcus.	30	Clathrocystis.

The color of the water at the surface has averaged 0.70, and the same figure holds good for the mid-depth also. The temperature of the surface has averaged about 53° Fahr. The following observations have been made during the past year on the brooks feeding the basin:

	No. of Obs.	Usual Color.	Minimum Color.	Maximum Color.
Stony Brook, below entrance of Angle Brook .	5	0.95	0.75	1.20
Stony Brook, above entrance of Angle Brook .	5	1.00	0.65	1.60
Stony Brook, above Southboro'	5	1.50	0.82	2.40
Angle Brook, below Broad Meadow Brook . .	5	0.85	0.60	1.00
Angle Brook, above Broad Meadow Brook . .	4	0.60	0.50	0.75
Broad Meadow Brook	3	1.20	1.10	1.50

The color of Stony-brook water throughout its whole length was at its highest point in July.

Basin 4.

Grades, H. W., 215.21; Stone crest, 214.21.

Area, 162 acres; Greatest depth, 49 feet; Contents, 1,416,400,000 gallons.

On Jan. 1, 1891, the surface of this basin stood at elevation 214.41, and water was wasting over the crest. This continued until January 24, when a waste-gate having been opened, the basin fell to 210.15, on January 31. The surface remained between 209 and 211 until March 26, when the waste-gate was closed, and the basin, on April 6, began to waste again over the stone crest. On May 9 a set of flash-boards were put on the dam, and a second set was added May 11. The basin was now kept at about 214.80 until July 15, when the storagewas drawn upon for the supply of the city. On September 26 the basin reached its lowest point, 202.91, when the gate was closed on account of work at the outlet. After this the water rose gradually to 207.77, on December 31.

Both sets of flash-boards were removed on October 3. The highest point reached by the water during the year was 215.20, on June 23, and the lowest, 202.90, on October 2.

On September 28 the force of men at work at the outlet of Lake Cochituate was transferred to Basin 4, and excavations begun for the new outlet to the overflow and pipes from the gate-house. It has been the intention of the Board to undertake this improvement for several years, but no proper opportunity has before presented itself. The 48-inch pipes under 50 feet head discharged formerly into the old brook channel, as did also the wasteway. There was no protection to the channel from scour, and the general appearance did not correspond with the substantial nature of the dam or the general work done by the city. The improvement consisted in digging a new outlet for the water with proper

alignment, and extending a canal through the meadow below as far as the first bridge. The first 287 feet of the channel was concreted and paved on the bottom and paved on the sides up to the high-water line. The concrete was finished on November 22, and the paving all completed on December 18. The excavations for the canal were then begun and are still in progress. Provision was made for inserting a temporary weir in the channel to measure the total leakage from the basin. Sheet piling, tongued and grooved, was driven on the line of the weir and connected with the masonry. The mud on the line of the improvement had to be excavated for some distance on each side of the new work and its place filled with coarse gravel. The total cost of the work on the outlet proper, including filling the old channels, building weirs, and under-draining the side hill, was \$10,635.

In the early part of the summer a weir was placed across Cold Spring brook, at the head of the basin, connected with a gauge-house in which was placed a self-registering apparatus. By this means a continuous profile of flow has been obtained, to study in connection with the amount drawn from the basin, and the effect on the surrounding water tables.

The gate-house, which has been heretofore covered with a temporary wooden floor, has been fitted with steel beams and iron cover plates, to correspond with the floors in the other gate-houses.

One thousand one hundred and fifty-eight feet of fence have been built at this basin during the past year, principally between the city land and that owned by Eames & Handy.

The quality of the water has been excellent. The following is a list of the predominant organisms, founded on weekly observations for two years, together with the number per cc. which these organisms are liable to reach:

- 150 *Cyclotella*.
- 100 *Protococcus*.
- 20 *Closterium*.

The temperature of the water at the surface has averaged about 53° Fahr. The temperature at the bottom in summer is about 51.5°. The color at the surface has averaged 0.55 during the year, and at mid-depth about 0.65. The mean of the influent is about 1.23. The difference between these figures shows the beneficial effect of long storage.

Until May the organisms were few in number; at that time *Synedra* began, which was soon followed by a much

larger growth of *Protococcus* and *Cyclotella*. The *Protococcus* lasted only a short time, but *Cyclotella* have remained abundant ever since. The growth has been chiefly at the surface. Amorphous matter was quite abundant during October, and but little stagnation at the bottom was observed.

The following observations have been made on the feeder of Basin 4 :

	No. of Obs.	Usual Color.	Minimum Color.	Maximum Color.
Cold Spring Brook, at basin influent	50	1.25	0.62	2.40
“ “ “ above Pond's mill	5	2.00	1.10	3.70

In the table appended to this report of this division will be found a detailed statement of the organisms which this basin contains and which are comparatively few in number.

WHITEHALL POND.

Elevation H. W., 327.91; Bottom of gates, 317.70; Area, 608 acres; Contents, 1,237,000,000 gallons.

On Jan. 1, 1891, the surface of the water in the pond stood at grade 324.91, three feet below high-water. On Jan. 25 the water had risen to 326.51, the highest point reached during the year. The surface then gradually fell to 326 on May 11. From this date the pond fell at the rate of about six inches per month until Nov. 26, when its surface stood at 322.43, the lowest point reached during the year. The water then rose to 322.94, on Dec. 31.

The waste-gates have been under the control of the mill-owners, and no attempts have been made to interfere with them. The gates have been closed from 2.30 P.M. Nov. 30 to 7 A.M. Dec. 1, and from 7 A.M. Dec. 4 to 7 A.M. Dec. 14,—a total of about $10\frac{3}{4}$ days. During the remainder of the year one gate has been open all the time, to provide water for the use of the mills. A weir measurement has been kept of the amount of the effluent. From the first week in February to the first week in April large quantities of water were wasted in order to prevent the pond from rising too high. Calculations show that it is not safe to keep the pond within two feet of high-water with the present lack of a spillway. All the water wasted or used from the pond has to pass through the gates, and these are not of sufficient capacity to pass a very severe freshet. The attention of the County Commissioners has been called to

the inadequate size of the culvert under the highway at Wood's shoe-shop. It will not pass more than 50,000,000 gallons in 24 hours.

The distinguishing feature of the organisms in Whitehall pond is the large number of Infusorias found in its water compared with the other sources of Boston's supply. In February, Dinobryon, Glenodinium, and Tintinnidium were abundant. In June, Uroglena-Volvox appeared, and on June 11 there were 150 colonies to the cc. in some portions of the pond. The water was distinctly red, and looked like a mud puddle. The odor was very disagreeable. The air, blowing from the pond, smelled oily. The next day it was found that the water had cleared, and in a few days the odor was gone, and the water practically as good as ever. This process of rapid decay is characteristic of this little animal, but the effect on such a large mass of water is very curious. In September the organisms averaged about 20 to the cc., and considerable fresh-water sponge was noticed growing on the old stumps in the shallow portions of the pond. On Oct. 29 approximately 50 organisms to the cc. were present, including 15 Uroglena-Volvox, 18 Asterionella, etc. A dredging plant, consisting of one dredge, one steamer, and three scows, has been built during the year, preparatory to dredging the mud and stumps whenever this work can be done. The total cost has been \$13,944.29. The first work on the plant was started on July 24, and completed December 31.

FARM POND.

Grade, H. W., 149.25 ; Area, 165 acres ; Contents, 167,500,000 gallons.

On Jan. 1, 1891, the water in this pond stood at grade 149.36. The surface has been kept at about high-water mark during the year. No water has been drawn from this source for the supply of the city.

The Framingham Water Company has pumped 80,500,000 gallons during the year, or 221,000 gallons daily.

The total amount of water wasted from the pond has been 184,200,000 gallons. The larger part of this was turned into the Sudbury river.

The highest elevation reached during the year was 149.99, on March 25, and the lowest, 148.68, November 23.

The frames to the screens in the gate-house having become decayed, were renewed. They have been in service since October, 1881.

LAKE COCHITUATE.

H. W. 134.36; Area, 800 acres; Capacity above 127.36, 1,508,000,000 gallons.

On Jan. 1, 1890, the lake stood at elevation 132.49, 1.87 feet below high-water. January 2 the waste-gate at the upper dam was opened, and, with the exception of 20 days, was kept open until April 25. During this interval the surface was kept at an average height of 133.20. On April 25 the water stood at 134.26. On May 5, the water still being at 134, the waste-gate was again opened, and the surface fell to 133.58 on May 11. The waste-gate was then finally closed, and the experiments on the flow of water over the new dam stopped. The lake gradually fell to 126.44, 7.92 feet below high-water, on November 26. On December 15 it was at 126.50, rising gradually to 127.32, on December 31.

Flash-boards were removed from the upper dam from January 25 to March 18, and from March 23 to April 11. The waste of water through the dam at outlet has amounted to 6,063,700,000 gallons.

A considerable amount of grading and other work has been accomplished during the year in the vicinity of the new dam. A bridge, supported on cast-iron brackets, has been built upon the crest of the new dam, and the brackets contain guides for a double set of stop-planks. April 1 the work of removing a portion of the old dam below the new dam was begun, the crest was lowered, and the old iron weir, 23 feet long, placed again in position at a lower level, with a channel of approach, etc., in order to measure accurately the water flowing over the new dam and determine certain coefficients. This work was hardly entered upon before it had to be abandoned for more pressing calls in other directions; but we hope to complete these experiments during the coming year. A road leading to the new dam has been built, its sides riprapped, the pool deepened between the dams, and the upper dam removed as far as possible, leaving only such parts of the embankment in position as will enable us to regulate the height of the water flowing over the new dam during the experiments. About 910 square yards of riprap and 113 square yards of paved gutter have been placed and about 5,000 cubic yards of earth removed.

During the autumn a large number of stumps were removed from the Snake brook meadow and other portions of the lake. Eleven thousand two hundred and eight feet of new fencing have been built and 12,808 feet of old fence repaired. The interior of the gate-house has been painted and repaired.

The quality of the water has been good throughout the

year. A table is appended showing the changes in the microscopical life from month to month, temperature, color, etc.

The following is a list of predominant organisms in Lake Cochituate, based on weekly observations for two years, together with the number of organisms per cc., sometimes reached, or which may be commonly looked for.

2,000 Asterionella.	150 Anabæna (sterile).
1,000 Tabellaria.	100 Cyclotella.
750 Melosira.	50 Microcystis.
300 Protococcus.	50 Monas.
250 Synedra.	25 Cœlospherium.
200 Crenothrix.	25 Clathrocystis.

The average temperature of the surface of the water has been about 53° Fahr., the mid depth 44°, and the bottom 42° at 70 feet. Concerning the average temperature at the bottom, I feel less sure every year. Our weekly observations, which are supposed to be taken to the tenth of a degree, show considerable variation, even during the period of stagnation. From July 13 to August 25 a thermometer enclosed in a large bottle was allowed to remain at the bottom. The average of eight observations made between those dates was 43.2° Fahr., the extremes being 43.1 and 43.4. On July 30 a careful observer was sent to the lake, and he found the temperature 43.2. The apparatus was lost on Sept. 3, and the thermometer was not left again at the bottom until September 23, which I think accounts for the high average in September, viz., 44.3°. From September 23 to the great turning over, the average of six observations gave 43.6. The grade of the surface was, however, about three feet lower than earlier in the season. From all the evidence in my possession, I am inclined to believe that, with a full lake, the bottom temperature would have been uniformly 43.2 from April to November; but this will be further investigated during the coming year.

At the beginning of 1891 Melosira and Asterionella were abundant. They decreased until March 1, when there were very few organisms. During April Asterionella multiplied rapidly, and on May 5 reached their maximum, 4,024 per cc., at the surface. The water had a slight local odor and taste characteristic of Asterionella. During May there was a slight growth of Tabellaria, Cyclotella, and Synedra. By the middle of June these had disappeared, and there were few diatoms during the summer months.

In June the Chlorophyceæ and Cyanophyceæ appeared and remained more or less abundant during the warm

weather. The water at the bottom of the lake began to be stagnant about the first of June. At first it became cloudy, then the color began to deepen, and continued to grow darker until Sept. 29, when it was a rich gold color, 5.00 on the Nessler scale. The amorphous matter in the meantime increased and *Crenothrix* became abundant.

On Nov. 3 this water was brought to the surface by the great overturning caused by temperature and gravitation, and there was a rapid increase of organisms. *Melosira*, *Asterionella*, and *Synedra* became abundant at all depths, and at the end of the year they were growing vigorously.

The temperature throughout the vertical did not become uniform until Nov. 10. On April 23 a careful examination of the water at fourteen different points was made, and in a general way the results were similar to those found the year before at the same time. The organisms were most abundant at the northerly end and decreased quite regularly towards the southern division. This regular decrease was most perfect in the case of the *Asterionella* at the surface. On Sept. 21 a layer of water about 15 feet deep and extending from 25 to 40 feet in depth had peculiar taste, and it was found to be due to the presence of about 14 *Synedra-Uvella* to the cc., an Infusorian formerly known to us by the name of *Hydromorum*.

The following examinations have been made of the brooks feeding the lake:

	No. of Obs.	Usual color.	Minimum color.	Maximum color.
Snake Brook, at mouth	3	0.30	0.30	0.35
Pegan Brook, at mouth	10	0.30	0.12	0.60
Dug Pond, outlet	10	0.18	0.10	0.30
Course Brook, at mouth	16	1.20	0.58	2.30
Beaver Dam Brook, above Waushaken . . .	4	1.50	1.00	2.30
Beaver Dam Brook, outlet of Waushaken . .	5	0.35	0.25	0.40
Beaver Dam Brook, at mouth	16	1.00	0.90	1.90

DUDLEY POND.

Grade, H. W., 146.46; 18-inch pipe, 130.36; 18-inch pipe, 127.36.

Area, 81 acres; Greatest depth, 27 feet; Contents, 250,000,000 gallons.

Water was drawn from this source between December 14 and December 31. When the stop-planks were removed from the inlet on the first-named date the water stood three feet below high-water, and the elevation of Lake Cochituate was 126.56.

On Jan. 1, 1892, the surface at Dudley pond had fallen to 139.46. The wooden stop-plank grooves in the gate chamber have been renewed.

SUDBURY-RIVER AQUEDUCT.

Grades, 141.352 at Farm pond ; 124.051 at terminal gate-house.

Length, 15.89 miles ; Size, 7 ft. 8 in. \times 9 ft.; Capacity, 109,000,000 gallons 24 hours.

The three portions of this aqueduct are in excellent condition. They have all been thoroughly cleaned twice during the year. The Supply and Farm pond aqueducts were cleaned by machine on June 8 and October 27. The main aqueduct was cleaned by machine on June 30 and December 1 between Farm pond and the West Syphon Chamber, and by hand between the East Syphon Chamber and Chestnut-hill Reservoir on January 15, 16, and November 17, 18. On June 15, 16 the upper portion of the main aqueduct was cleaned by hand on those portions of the brickwork not reached by the machine, and comprising the upper arch. The bottom of Rockland-street tunnel was thoroughly cleaned and swept on December 8 and 9, and the bottom of the Badger-hill tunnel on December 14 and 15. *Spongilla fluviatilis* grows in these places, and it was all removed.

The water has been run through the whole length of all three aqueducts from the gate-house of Dam 1 throughout the year, which means that Farm pond has not been used as an intermediate storage reservoir, as is sometimes done. The water in Farm pond is now so good that it will be used during the coming year.

Owing to work on the Beacon-street tunnel, the aqueducts have been in use only during 274 days. They have carried 8,306,600,000 gallons to the city, or a daily average of 22,757,800 gallons for the year.

During the first week in September a large amount of dirt began to collect on the screens in the Farm-pond gate-house. The flow of the water was so seriously retarded that from September 16 to October 27 the screens had to be cleaned constantly day and night ; on the latter date, while cleaning the interiors, the Supply and Farm pond aqueducts were found to be very dirty. The 48-inch pipe in Basin 1 collects a great deal of dirt from the bottom of this basin, owing to its leaky condition, which shows the importance of taking this work in hand. The pipe-line has been flushed into the river below Dam 1 five times during the year.

The work of lining the Beacon-street tunnel was continued this year between Dec. 22, 1890, and May 7, 1891. About 342 feet of lining was placed in this interval. Work was

begun at Station 808+94.6 and finished at Station 810, connecting at this latter point with the old brick lining put in when the aqueduct was built. Work was then pushed in a westerly direction, beginning at Station 803+21 and completed to Station 800+95. Total length of lining completed between October, 1889, and the present date, 905 feet. We have lately been preparing to begin again the third season's work in the tunnel.

The cost of laying concrete this past year has been \$13.14 per cubic yard, exclusive of cost of track. Nine hundred and ninety-six cubic yards were placed. The work is done under great difficulties, but has been admirably managed by Mr. J. W. Oldham, the foreman in charge.

No extensive repairs have been found necessary to the structures along the line of the aqueduct. The terminal gate-house, however, was thoroughly pointed in the autumn. The embankments have received the usual attention, and the watercourses and culverts have been cleaned.

COCHITUATE AQUEDUCT.

Grades, 121.03 at lake ; 116.77 at Brookline reservoir.

Length, 14.60 miles ; Size, 5 ft. \times 6 ft. 4 in. ; Capacity, 20,000,000 gallons per 24 hours.

This aqueduct has been in constant service throughout the year with the exception of twelve and one-half days, seven for cleaning and five and one-half for repairs on break in syphon line. A depth of six and one-half feet was maintained until October 18, which was as long as the height of the lake would permit the running of this amount of water. Since that date the depth at the intake has fluctuated with the varying heights of the lake.

On May 25, 26, 27, and again on November 9, 10, and 11, this aqueduct was thoroughly cleaned from the lake to Brookline reservoir. On the latter date the brickwork was very dirty, especially for the first 4,000 feet from the inlet.

On Sunday, April 19, a leak was discovered in the upper of the syphon pipes crossing the Charles-river valley at Newton Lower Falls. The leak was found by a little girl, who notified Mr. Ware, and although the side of the hill was washed out somewhat by the break, the water was shut off before serious results ensued.

The former break at this point, in March, 1859, was a disaster of considerable magnitude ; but a repetition was happily avoided. There are four syphon lines at this point, one 36-inch pipe, two 30-inch pipes, and one 40-inch pipe. The break in 1891 was on the 40-inch line, and caused by the illegal filling of a street which carried the bell of the upper pipe down into the pipe below.

The ventilator was pointed September 28 to October 5, with Portland and elastic cements. No important repairs have been made on the rest of the aqueduct, but the bushes have been mowed and the embankments and fences repaired in the usual manner.

CHESTNUT-HILL RESERVOIR.

H. W., 125.00; Dam, 128.00; Effluent pipes, 99.80.

Area, Lawrence Basin, 37.5 acres; Contents, 166,000,000 gallons; Bradlee Basin, 87.5 acres; Contents, 391,000,000. Total contents above grade one hundred, 557,000,000 gallons.

A large amount of work has been done at this point during the year. The grounds have not only been kept up to their usual high standard of maintenance, but extensive improvements have been inaugurated. The old circles near the intermediate gate-house have been taken out and the lines of the driveway changed so as materially to improve the appearance of the reservoir. The old road to Beacon street has been turned into a triangle to be planted with shrubs, and two new driveways opened, one on each side of the triangle. The work is still incomplete. A large number of hardy shrubs have been obtained and set out in the nursery preparatory to spring planting.

A new fence has been erected between the reservoir grounds and the cemetery. A police-signal system has been put around the driveway, connected with a Hall registering clock in the Superintendent's office, so that a daily register can be made of the beats of the police officers. The cost was about \$1,800. The driveways have been kept in good order.

The quality of the water in Chestnut-hill Reservoir has been good throughout the year. It is exceedingly difficult with the present awkward arrangement of inlets to provide a thorough mixture of Sudbury and Cochituate water. The former arrives, generally, at the reservoir with a color of 0.75, and the latter with a color of 0.25. To produce a satisfactory result they should both enter the Lawrence basin at the farthest point from the outlet. I have found, after careful study, that with the old order of things the Lawrence basin has been practically useless as influencing the stored water, as its water has been practically colorless from long standing and from the difficulty of making it play its part in the circulation. I have succeeded, after a number of experiments, and by keeping its surface somewhat higher than the Bradlee basin, in increasing its color and lessening that in the lower basin, but a few radical changes need to be made to produce a perfect result.

BROOKLINE RESERVOIR.

H. W., 125.00; Area, 23 acres; Greatest depth, 24 feet; Contents, 119,583,960 gallons.

Everything in connection with the Brookline reservoir is in good order. One-half of the water used in Boston has been sent through this reservoir during the year. The water has been of the usual good quality. The effluent gate-house was thoroughly pointed during the autumn, and painted inside. No other work beyond the usual maintenance has been done.

FISHER-HILL RESERVOIR.

H. W., 241.00; Pipe inverts, 220.00; depth, 21 feet; Contents, 15,400,000 above 223.

The reservoir is in good condition. The grounds have been maintained as usual by the Chestnut-hill Reservoir force.

BIOLOGICAL LABORATORY.

This laboratory has turned out excellent work throughout the year. Besides the usual weekly examinations of the waters in all the storage reservoirs and sources of supply, sixty-five special reports have been made on subjects demanding investigation, such as the condition of the brooks feeding the Sudbury and Cochituate supplies. In the latter part of the year determinations of the bacteria in the water have been added to the other biological work. Photographs have been made from time to time of micro-organisms in the water, and after much trouble in this branch of the work we have succeeded in producing excellent plates. Four subjects have been reproduced by the heliotype process, and are shown in the accompanying plates.

FILTRATION EXPERIMENTS.

These experiments have been carried on continually at Chestnut-hill Reservoir, and much information collected during the year.

INSPECTION OF POLLUTIONS DEPARTMENT.

The following is a digest of the operations of the department for the year:

Total number of cases prepared for City Solicitor	31
Injunctions granted	17
Petitions for injunctions filed	6

Cases given to City Solicitor, but not filed in court	.	8
Legal notices sent	. . . . .	70
Cases inspected (old)	. . . . .	499
“ “ (new)	. . . . .	63

Of the 562 cases inspected, 152 are reported as "Remedied," 309 as "Safe at present," 45 "Seem safe," 9 "Suspected," 47 "Unsatisfactory."

QUALITY OF THE WATER.

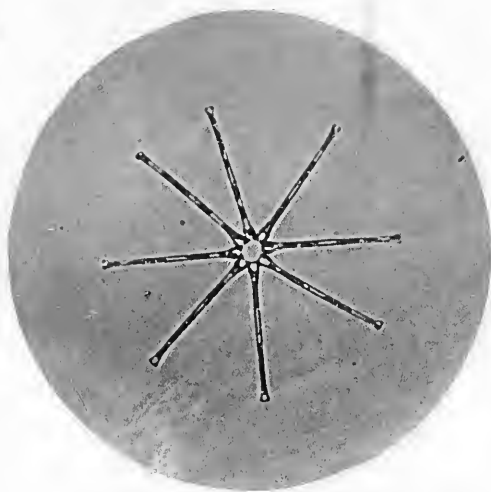
The quality of the water has on the whole been very good throughout the year.

The following tables give, first, the average condition of the water as delivered at a tap in Boston during the year 1891, from analyses by Dr. Thomas M. Drown; and, secondly, means of quarterly analyses of 1890-2 of different portions of the supply. They afford a ready means for comparison with the condition of the water as given in the last annual report.

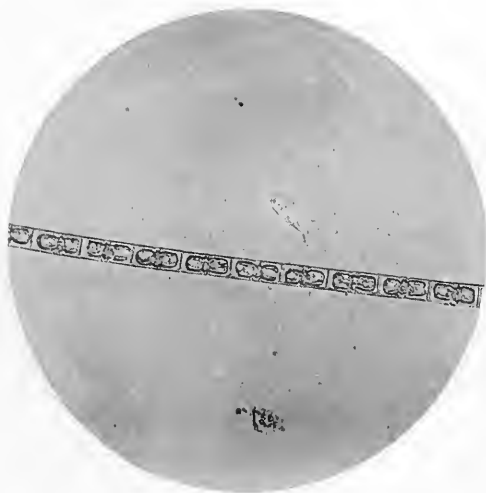
The succeeding tables contain the average results of biological examinations made during the past year, together with temperature observations and rainfall records.

DESMOND FITZGERALD,

Resident Engineer and Supt.



ASTERIONELLA (DIATOMACEÆ) \times 285

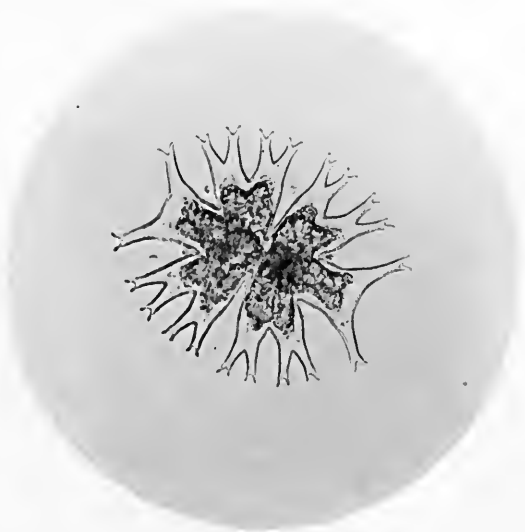


MELOSIRA (DIATOMACEÆ) \times 285





CLOSTERIUM (DESMIDIEÆ) $\times 200$



MICRASTERIAS (DESMIDIEÆ) $\times 200$

Table I.—Tap Water, Boston, 1891.
PARTS IN 100,000.

LOCALITY.	RESIDUE ON EVAPORATION.			CHLORINE.		NITROGEN.				Oxygen Consumed.	Hardness.	REMARKS.
	Total.	Loss on Ignition.	Fixed.			Albuminoid Ammonia.	Filtered.	Free Ammonia.	As Nitrites.	As Nitrates.		
Service-pipe, Mass. Inst. of Technology,	0.37	4.39	1.63	2.76	0.37	.0161	.0133	.0005	.0001	.0227	0.40	1.7
												Means of monthly analyses.

TABLE II.
Means of Monthly Analyses, June, 1889, to December, 1891, by Dr. Thomas M. Drown.
 PARTS PER 100,000.

SOURCE.	Color.	RESIDUE ON EVAPORATION.			Chlorine.	NITROGEN.					Oxygen Con- sumed.	Hardness.	REMARKS.
		Total.	Loss on Ignit'n.			Albuminoid Ammonia.		Free Am- monia.	As Nitrates.	As Nitrates.			
			Fixed.	Un- filtered.		Un- filtered.	Fil- tered.						
Sudbury River, Upper end Res. No. 2, samples collected 1 ft. beneath surface	1.09	4.65	1.90	2.72	.29	.0283	.0248	.0013	.0001	.0110	0.89	1.3	
Reservoir No. 2, near gate-house, sam- ples collected 3 ft. beneath surface . .	0.86	4.21	1.73	2.47	.27	.0257	.0215	.0010	.0001	.0102	0.64	1.2	
Stony Brook, Upper end Res. No. 3, samples collected 1 ft. beneath surface	0.92	6.54	2.20	4.34	.57	.0293	.0260	.0034	.0003	.0239	0.87	2.1	
Reservoir No. 3, near gate-house, sam- ples collected 8 ft. beneath surface . . .	0.71	4.97	1.72	3.24	.40	.0267	.0221	.0030	.0002	.0187	0.63	1.8	
Cold Spring Brook, at head of Reservoir No. 4	1.37	4.72	2.20	2.54	.24	.0301	.0269	.0014	.0001	.0091	0.36	1.3	
Reservoir No. 4, near gate-house, sam- ples collected 1 ft. beneath surface . . .	0.69	3.38	1.50	1.88	.21	.0218	.0186	.0010	.0001	.0073	0.54	1.1	
Reservoir No. 4, near gate-house, sam- ples collected 20 ft. beneath surface . .	0.75	3.72	1.61	2.15	.22	.0222	.0186	.0022	.0001	.0089	. . .	1.4	
Reservoir No. 4, near gate-house, sam- ples collected near bottom	0.74	3.82	1.52	2.35	.23	.0203	.0176	.0022	.0001	.0107	. . .	1.4	
Farm Pond, at gate-house	0.11	4.92	1.38	3.53	.62	.0204	.0171	.0022	.0001	.0094	0.18	2.0	
Dudley Pond	0.65	3.15	1.00	2.15	.23	.0274	.0229	.0019	.0000	.0035	. . .	1.3	Means, June to Sept., 1889, inclusive.
Lake Cochituate, gate-house	0.23	4.70	1.30	3.36	0.45	.0189	.0154	.0019	.0002	.0199	0.29	2.0	
Parker-hill Reservoir	0.14	. . .	. . .	. . .	.44	.0183	.0159	.0011	.0002	.0103	. . .	. . .	Means, June to Nov., 1889, in- clusive.
Service-pipes, Mass. Inst. Tech., Boston .	0.41	4.52	1.50	2.99	.40	.0177	.0153	.0004	.0001	.0225	. . .	1.8	June, 1889, to Dec., 1891, in- clusive.

TABLE III.
Lake Cochituate, 1891.

Month.	ORGANISMS.				AMORPHOUS.				REMARKS.
	Sur.	Mid.	Bot.	Mean.	Sur.	Mid.	Bot.	Mean.	
January	207	324	631	408	71	71	179	107	Diatoms, chiefly. { Melosira. } Asterionella.
February	79	156	165	133	60	63	113	79	{ Melosira. } Asterionella.
March	145	170	238	185	59	75	170	101	{ Asterionella. } Melosira. { Crenothrix, at the bottom.
April	1,127	930	689	915	119	95	112	100	{ Asterionella. } Melosira. { Infusoria.
May	2,732	1,312	1,028	1,691	171	144	464	200	{ Asterionella. } Tabellaria. { Infusoria. } Cyclotella. { Infusoria.
June	700	246	788	578	171	148	2,347	889	{ Chlorophyceae. } Cyclotella. { Crenothrix, at the bottom.
July	247	138	499	295	110	139	3,262	1,172	{ Chlorophyceae. } Synedra. Crenothrix, at the bottom.
August	214	179	481	291	113	277	2,957	1,116	{ Chlorophyceae. } " " "
September	188	160	150	166	78	169	1,370	539	{ Chlorophyceae. } Synura, at mid depth.
October	375	253	145	258	126	234	1,448	603	{ Synedra. } Asterionella. { Crenothrix, at bottom.
November	1,045	1,077	952	1,025	247	214	253	237	{ Melosira. } Synedra. { Infusoria. } Cyanophyceae. { at bottom.
December	1,712	1,886	2,038	1,872	225	206	209	213	{ Melosira. } Asterionella. { Infusoria. } Synedra. { Infusoria.
Mean	736	509	650	651	129	153	1,074	452	

Desmidiaceae, Chlorophyceae, Infusoria, Rotifera, present in small numbers throughout the year. The above figures are based on examinations made once each week.

TABLE III. — *Continued.*
Basin 2, 1891.

MONTH.	ORGANISMS.					AMORPHOUS.					REMARKS.
	Sur.	Mid.	Bot.	Mean.	Influent.	Sur.	Mid.	Bot.	Mean.	Influent.	
January	21	17	18	19	25	45	42	85	57	38	Diatoms. Moulds.
February	22	12	9	14	17	37	62	57	52	59	"
March	18	18	14	17	26	51	58	75	61	42	"
April	63	60	46	56	34	65	90	111	89	47	{ Synedra. { Tabellaria. Infusoria.
May	284	269	246	266	154	500	386	464	448	225	{ Synedra. { Chlorophyceae.
June	163	173	139	158	85	215	234	436	295	242	{ Cyclotella. { Synedra.
July	276	281	307	288	112	388	580	906	625	250	{ Chlorophyceae. { Synedra.
August	309	300	364	324	172	660	698	1,213	857	449	{ Cyclotella. { Chlorophyceae.
September	571	426	472	490	192	654	652	704	670	388	{ Synedra. { Chlorophyceae.
October	1,014	829	664	836	100	887	803	621	770	360	{ Cyclotella. { Synedra.
November	987	780	828	865	55	347	452	399	399	140	{ Chlorophyceae. { Cyclotella.
December	134	107	104	115	25	213	304	524	244	281	{ Chlorophyceae. { Synedra.
Mean	322	273	268	288	83	338	363	443	381	210	"

Zoospores, Infusoria, and Rotifera present in small numbers at all seasons.

The above figures are based on examinations made once a week.

TABLE III. — *Continued.*
Basin 3, 1891.

MONTH.	ORGANISMS, CC.					AMORPHOUS.				REMARKS.	
	Sur.	Mid.	Bot.	Mean.	Influent.	Sur.	id.	Bot.	Mean.		Effluent.
January	26	36	45	36	10	54	90	64	69	36	Diatoms.
February	12	8	11	10	23	81	84	85	83	150	Diatoms. Moulds.
March	12	15	11	13	25	50	79	77	69	56	Diatoms.
April	211	209	182	201	72	93	86	98	92	50	Diatoms. { Synedra. Tabellaria. Asterionella.
May	549	514	770	611	157	206	262	440	303	171	{ Diatoms. { Synedra. Tabellaria. Asterionella.
June	175	157	180	171	75	158	192	1065	472	360	{ Chlorophyceae. Chlorophyceae. Cyanophyceae.
July	150	187	412	260	145	235	442	3139	1273	407	{ Crenothrix, at bottom. Chlorophyceae. Cyanophyceae crenothrix.
August	305	347	258	303	185	298	509	1506	772	202	{ Chlorophyceae. Diatoms, at bottom. Cyanophyceae crenothrix.
September	233	244	282	253	801	335	381	1336	684	710	{ Infusoria, at bottom. Chlorophyceae. Cyanophyceae.
October	313	292	411	339	406	512	454	614	527	254	{ Chlorophyceae. Cyanophyceae, Diatoms (Asterionella). Infusoria.
November	1020	949	1033	1001	48	289	350	322	320	77	{ Diatoms (Asterionella). Chlorophyceae. Cyanophyceae, Infusoria.
December	320	242	250	257	34	249	210	231	217	139	{ Diatoms. Chlorophyceae. Infusoria.
Mean	277	207	323	288	165	213	261	748	407	226	

Zoospores, Desmidiæ, Chlorophyceae, Infusoria, Rotifera, are found in small numbers throughout the year.
The above figures are based on examinations made once each week.

TABLE III.—Continued.
Basin 4, 1891.

MONTH.	ORGANISMS.					AMORPHOUS.					REMARKS.
	Sur.	Mid.	Bot.	Mean.	Influent.	Sur.	Mid.	Bot.	Mean.	Influent.	
January	25	19	22	22	12	32	38	60	43	28	Diatoms. Moulds.
February	11	10	13	11	15	39	57	56	51	50	"
March	10	7	6	8	18	31	49	45	42	33	" Infusoria.
April	34	25	27	29	30	45	63	65	58	43	"
May	71	70	56	66	73	77	89	82	83	111	Diatoms (Synedra). Chlorophyceae.
June	244	103	64	137	77	128	108	160	132	98	Diatoms (Cyclotella). Chlorophyceae.
July	211	103	54	123	21	102	110	145	119	74	Diatoms (Cyclotella). Chlorophyceae.
August	214	159	91	155	32	200	251	424	292	76	Diatoms (Cyclotella). Chlorophyceae.
September	167	68	40	91	67	201	262	386	283	56	"
October	149	128	111	129	57	322	412	516	419	84	"
November	240	194	241	225	34	197	220	184	200	71	"
December	179	257	275	237	10	84	134	148	122	30	"
Mean	129	95	83	103	37	121	150	190	154	63	

Zoospores frequently present.
The above figures are based on examinations made once each week.

TABLE III. — *Concluded.*

MONTH.	CHESTNUT-HILL RESERVOIR.						BROOKLINE RESERVOIR.		TAPS IN CITY.			
	Organisms.			Amorphous.			Effluent G. H.		Organisms, cc.		Amorphous.	
	Effluent G. H.	Sudbury G. H.	Cochituate G. H.	Effluent G. H.	Sudbury G. H.	Cochituate G. H.						
January	138	20	312	49	36	65	115	90	50	32	10	
February	97	11	87	67	35	40	54	53	32	26	16	
March	123	9	112	43	29	38	96	65	24	30	27	
April	349	109	921	70	66	63	378	342	124	134	47	
May	671	494	2,115	225	392	156	597	494	251	216	40	
June	338	147	591	141	212	100	214	408	137	271	73	
July	301	197	332	215	471	154	191	211	77	289	205	
August	229	208	207	200	472	129	142	141	46	172	89	
September	167	189	167	167	415	109	181	116	49	102	85	
October	184	421	378	115	371	137	229	175	61	211	55	
November	380	730	847	138	250	150	565	473	92	160	51	
December	428	213	1,279	177	440	172	433	410	87	180	96	
Mean	284	229	613	135	266	109	266	248	86	152	66	

The above figures are based on weekly examinations.

TABLE IV.
Temperatures for 1891 (Fahrenheit).

MONTH.	LAKE COCHITUATE.			BASIN 2.			BASIN 3.			BASIN 4.		
	Sur.	Mid.	Bot.	Sur.	Mid.	Bot.	Sur.	Mid.	Bot.	Sur.	Mid.	Bot.
January	34.4	35.2	36.2	33.4	34.0	35.3	34.0	36.4	38.7	33.7	37.4	38.6
February	34.3	35.8	36.9	33.8	34.4	35.5	34.1	34.7	36.7	33.4	36.8	39.3
March	35.8	36.9	37.4	36.5	37.2	37.8	35.3	36.2	37.4	34.5	37.1	39.3
April	48.6	44.5	43.2	51.2	50.8	50.4	50.5	49.3	49.2	48.5	46.6	44.8
May	56.4	47.8	43.5	59.6	58.6	58.1	58.6	57.2	56.5	56.6	54.6	49.8
June	69.1	48.9	44.4	69.7	67.0	63.7	68.3	66.2	58.7	66.9	55.4	51.0
July	73.9	48.9	43.4	74.9	72.5	70.3	74.3	71.7	61.8	73.7	59.4	51.4
August	74.4	50.3	43.7	74.4	73.1	72.4	74.1	72.4	63.5	74.5	59.0	52.0
September	71.2	50.2	44.3	70.6	69.9	68.9	70.6	70.0	66.7	69.1	55.8	52.2
October	57.4	48.8	43.7	54.2	54.2	26.4	56.4	56.4	56.0	56.7	53.7	51.6
November	45.4	45.4	44.6	42.8	42.9	43.0	42.6	43.1	41.6	46.4	45.8	45.7
December	39.3	39.3	39.9	35.9	36.8	37.1	35.5	35.9	36.3	38.5	38.9	39.0
Mean	53.3	44.3	41.8	53.1	52.6	52.2	52.8	52.6	50.3	52.7	48.0	46.2

The above figures are based on observations made once each week.

TABLE IV.

Temperatures for 1891 (Fahrenheit).— *Concluded.*

MONTH.	CHESTNUT-HILL RESERVOIR GATE-HOUSES.			CHESTNUT-HILL RESERVOIR.			BROOKLINE RESERVOIR. G. H.	TAP. Boston Common.	TAP. Mattapan.
	Sudbury.	Coelitate.	Effluent.	Sur.	Mid.	Bot.			
January	35.8	36.0	34.6	. . .	. . .	. . .	36.1	39.9	42.0
February	34.8	36.8	36.2	33.2	34.8	35.5	35.8	40.7	39.9
March	36.4	37.3	36.8	37.7	37.6	37.9	37.4	41.8	39.9
April	48.8	46.0	48.6	49.0	48.4	46.4	48.2	48.8	44.2
May	57.0	55.9	57.4	57.9	56.3	54.5	56.9	56.2	50.7
June	62.1	65.3	66.1	67.0	65.0	56.3	64.6	64.4	56.9
July	71.9	71.5	72.3	73.4	70.2	57.2	71.7	70.8	60.6
August	72.2	72.9	73.6	74.9	72.4	58.7	72.8	72.1	62.9
September	69.8	69.2	69.3	70.4	68.8	59.5	69.4	69.0	62.5
October	57.5	58.8	58.5	58.8	58.7	57.2	58.8	59.9	59.1
November	44.5	46.5	45.2	45.2	45.6	45.1	44.4	47.3	51.4
December	38.2	40.4	38.5	38.2	38.4	38.6	38.7	41.7	47.0
Mean	52.4	53.0	53.1	55.0	54.2	49.7	52.9	54.4	51.4

The above figures are based on weekly observations.

TABLE V.
Colors, 1891 (Nessler Scale).

MONTH.	LAKE COCHITUATE.					BASIN 2.					BASIN 3.					BASIN 4.				
	Sur.	Mid.	Bot.	Mean.	*In-fluent.	Sur.	Mid.	Bot.	Mean.	Influent.	Sur.	Mid.	Bot.	Mean.	Influent.	Sur.	Mid.	Bot.	Mean.	Influent.
January . . . . .	.22	.22	.27	.24	.63	.60	.78	.77	.72	.77	.54	.75	.84	.71	.83	.83	.80	.81	.81	.88
February . . . . .	.35	.27	.46	.36	.58	.45	.62	.65	.57	.66	.44	.46	.56	.48	.60	.21	.74	.75	.57	.85
March . . . . .	.33	.38	.45	.39	.49	.45	.48	.49	.47	.48	.48	.47	.48	.48	.52	.49	.63	.71	.63	.76
April . . . . .	.39	.39	.39	.39	.89	.69	.68	.68	.68	.88	.64	.63	.64	.64	.90	.66	.67	.66	.66	1.11
May . . . . .	.35	.35	.57	.42	.89	.92	.93	.94	.93	1.05	.87	.86	.88	.87	1.19	.75	.71	.71	.72	1.40
June . . . . .	.31	.34	1.19	.61	.99	.91	.92	.95	.93	1.25	.86	.86	1.18	.97	1.38	.73	.72	.72	.72	1.46
July . . . . .	.21	.28	1.51	.66	.60	.90	.89	.99	.92	1.00	.74	.75	2.02	1.17	1.20	.61	.61	.65	.62	1.21
August . . . . .	.19	.38	2.56	1.04	.67	.84	.89	.95	.89	.93	.70	.79	3.17	1.55	.91	.55	.71	.74	.66	1.03
September . . . . .	.13	.39	2.93	1.15	.92	.79	.81	.85	.81	.92	.70	.70	.82	.74	.89	.45	.62	.74	.60	1.39
October . . . . .	.16	.38	3.75	1.43	.38	.88	.89	.90	.89	.96	.69	.69	.72	.70	.71	.47	.58	.82	.62	1.59
November . . . . .	.33	.33	.34	.33	.90	.83	.83	.84	.83	.95	.64	.63	.64	.64	.63	.40	.44	.45	.43	1.40
December . . . . .	.33	.33	.37	.34	.83	1.12	1.10	1.13	1.12	1.21	.86	.87	.87	.87	1.27	.45	.47	.47	.46	1.73
Mean . . . . .	.28	.34	1.23	.61	.77	.78	.82	.85	.82	.92	.70	.70	1.07	.82	.92	.55	.65	.68	.63	1.23

* Estimate based on colors taken in Beaver Dam, Course, Pegan, and Snake brooks, and disregarding spring-water.
The above figures are based on weekly observations.

Table V. — Colors, 1891. — *Concluded.*

MONTH.	CHESTNUT-HILL RESERVOIR. GATE-HOUSES.			CHESTNUT-HILL RESER- VOIR.				BROOKLINE RESER- VOIR. Gate-Houses.	TAP. Boston Common.	TAP. Matapan.
	Sudbury.	Cochituate.	Effluent.	Sur.	Mid.	Bot.	Mean.			
January . . . .	.76	.22	.41	. . .	. . .	. . .	. . .	.45	.42	.38
February . . . .	.64	.30	.37	.26	.37	.40	.34	.41	.35	.33
March . . . . .	.51	.37	.41	.41	.41	.42	.41	.41	.39	.30
April . . . . .	.63	.35	.44	.45	.45	.45	.45	.48	.42	.32
May . . . . .	.90	.33	.45	.48	.48	.48	.48	.72	.51	.41
June . . . . .	.90	.27	.49	.52	.52	.43	.49	.77	.58	.61
July . . . . .	.82	.18	.40	.40	.41	.41	.41	.65	.51	.55
August . . . . .	.83	.17	.39	.40	.41	.82	.54	.53	.42	.42
September . . .	.81	.15	.37	.36	.36	1.80	.34	.40	.35	.38
October . . . .	.70	.12	.33	.34	.35	.67	.45	.36	.41	.34
November . . .	.70	.25	.37	.37	.37	.38	.37	.39	.37	.31
December	1.06	.27	.50	.48	.48	.47	.48	.59	.52	.43
Mean . . . . .	.77	.25	.41	.40	.42	.61	.48	.51	.44	.40

The above figures are based on observations made once each week.

TABLE VI.
Expended for Maintenance, Western Division, Jan. 1, 1891, to Jan. 31, 1892, inclusive (13 Months).

	Western Division.	Basins.	Subsidiary Aqueduct.	Cochituate Aqueduct.	Lake Cochituate.	Chestnut Hill Reservoir.	C. H. Driveway.	Brookline Reservoir.	Fisher-Hill Reservoir.	Biological Department.	Inspection Department.	Filtration.	Lining Tunnel.	Improvement Lake Cochituate.	Protection of Supply Surveys.	Total.
Jan. 1, 1891	\$746 60	\$704 39	\$626 96	\$112 26	\$63 51	\$1,208 06	\$1,201 91	\$155 52	\$91 78	\$258 73	\$507 03	\$494 90	\$79 66	88 74	.....	\$7,160 65
Feb. 1, "	727 08	441 03	338 17	381 83	244 63	941 79	378 18	170 02	45 73	253 10	414 00	448 52	1,647 84	212 07	.....	6,643 99
Mar. 1, "	854 87	522 58	200 90	142 97	240 15	721 94	390 58	176 70	80 55	322 34	436 11	1,107 34	3,718 93	1,070 47	.....	9,986 13
Apr. 1, "	1,072 58	2,490 41	563 46	171 94	252 30	2,328 59	721 82	433 50	389 30	412 65	930 44	1,337 16	5,808 35	288 89	.....	17,461 39
May 1, "	378 42	409 14	56 42	66 00	11 29	209 28	43 82	.....	.....	285 40	46 87	343 94	708 65	75 97	.....	2,755 20
June 1, "	921 34	615 69	263 68	168 44	167 94	1,148 11	1,007 91	82 00	156 10	297 13	531 42	565 66	1,425 32	263 15	.....	7,573 89
July 1, "	946 24	646 48	431 27	637 69	322 31	2,063 86	802 95	73 75	71 00	301 83	371 31	829 99	209 64	254 33	\$57 55	8,020 20
Aug. 1, "	1,115 33	1,173 27	425 77	182 98	240 10	1,283 38	579 85	233 50	315 50	441 98	481 16	576 13	6 36	706 97	440 74	8,153 02
Sept. 1, "	1,343 20	877 51	364 09	193 33	743 82	1,134 44	1,921 84	105 50	111 25	482 77	490 06	650 57	8 55	648 61	571 69	9,647 23
Oct. 1, "	1,021 01	469 18	337 22	205 28	397 50	1,327 18	1,273 68	133 25	65 75	274 63	383 16	509 53	.....	601 90	326 43	7,325 70
Nov. 1, "	1,198 32	2,560 67	592 56	310 00	638 21	1,521 08	1,362 67	356 53	146 47	406 46	433 04	793 38	13 50	276 70	344 50	10,893 74
Dec. 1, "	1,078 14	5,314 22	496 51	472 09	346 60	1,861 72	889 26	134 25	116 20	405 18	485 41	608 87	244 14	165 80	370 38	12,988 77
Jan. 1-31, 1892	2,000 15	7,581 66	742 32	361 00	872 85	4,411 14	1,654 35	121 58	177 50	782 92	873 52	894 15	3,476 79	.....	774 66	24,724 59
Totals	\$13,343 28	\$23,806 23	\$5,439 33	\$3,705 51	\$4,541 21	\$20,411 17	\$12,348 82	\$2,176 10	\$1,707 13	\$4,925 12	\$6,293 53	\$9,160 14	\$17,467 38	\$5,053 60	\$2,886 05	\$133,334 50

TABLE VII.

Table of Rainfall at Chestnut-Hill Reservoir for Year ending
Dec. 31, 1891.

DATE.	Inches.	Snow or Rain.	Duration.	DATE.	Inches.	Snow or Rain.	Duration.
Jan. 1	1.55	Snow and Rain.	8.30 a.m. to 7.45 a.m.	Mar. 3	1.77	Snow.	7.30 a.m. to 11.30 p.m.
" 2				" 4			
" 3				" 9	0.77	Rain.	10.00 a.m. to 4.00 a.m.
" 5	0.35	Snow.	5.30 a.m. to 10.30 p.m.	" 10			
" 11	1.06	Rain.	12.30 p.m. to 9.30 a.m.	" 12	0.83	"	6.00 p.m. to 10.00 p.m.
" 12				" 13			
" 14	0.03	Snow.	5.00 a.m. to 7.30 a.m.	" 19	0.08	Snow.	6.30 a.m. to 6.00 p.m.
" 17	1.72	Snow and Rain.	8.10 a.m. to 6.30 p.m.	" 20	2.18	Rain.	5.15 p.m. to 6.00 p.m.
" 18				" 21			
" 22	1.09	Rain.	6.00 a.m. to 6.00 p.m.	" 22			
" 25	0.76	Snow.	5.30 a.m. to 2.00 p.m.	Total.	5.63		
" 29	0.37	Snow and Rain.	4.00 a.m. to 10.30 p.m.				
" 31	0.05	Rain.	7.30 p.m. to midnight.	Apr. 2	1.83	Rain.	8.00 p.m. to 1.00 a.m.
Total.	6.98			" 3			
				" 4			
Feb. 1	0.29	Rain.	Midnight, Jan. 31, to 11.00 a.m.	" 11	0.33	"	7.00 a.m. to 6.00 a.m.
" 3	0.52	"	10.15 a.m. to 6.30 p.m.	" 12			
" 6	0.20	Snow and Rain.	6.50 a.m. to 5.00 p.m.	" 15	0.58	"	1.45 a.m. to 10.00 a.m.
" 7	0.78	Snow.	6.10 p.m. to 6.30 p.m.	" 18	0.15	"	8.00 p.m. to 1.00 a.m.
" 8				" 19			
" 9				" 25	0.09	Lt. Snow and Rain.	7.30 a.m. to 2.30 p.m.
" 10	0.80	Snow and Rain.	1.30 p.m. to 11.00 a.m.	Total.	2.98		
" 16	0.35	Rain.	1.20 a.m. to 8.30 p.m.				
" 17	0.24	"	3.00 a.m. to 12.30 p.m.	May 3	0.10	Rain.	10.30 a.m. to 5.30 p.m.
" 20	0.79	Snow and Rain.	9.45 a.m. to 7.15 a.m.	" 15	1.43	"	10.00 p.m. to 3.00 a.m.
" 21				" 16			
" 22				" 17			
" 25	1.20	Rain and Snow.	4.30 p.m. to 9.30 a.m.	" 26	0.10	"	3.40 p.m. to 7.45 p.m.
" 26				" 29	0.42	"	4.00 a.m. to 9.00 p.m.
" 27				Total.	2.05		
" 28	0.12	Snow.	6.45 p.m. to 9.45 p.m.				
Total.	5.29			June 2	0.46	Rain.	6.00 p.m. to 9.00 p.m.

Table of Rainfall at Chestnut-Hill Reservoir.—*Continued.*

DATE.	Inches.	Snow or Rain.	Duration.	DATE.	Inches.	Snow or Rain.	Duration.		
June 3	0.42	Rain.	10.00 p.m. to 4.00 a.m.	Aug. 27	1.17	Rain.	1.00 p.m. to 10.30 p.m.		
" 4				" 28					
" 17	1.15	Showers and Mist.	12.30 p.m. to 9.30 p.m.	" 30	0.50	"	5.30 a.m. to midnight.		
" 18				" 31					
" 19				Total.				4.02	
" 20									
" 21	1.75	Rain.	9.30 p.m. to 3.30 p.m.	Sept. 1	0.02	Mist.	Midnight, Aug. 31, to 9.45 a.m.		
" 22				" 5	2.83	Rain.	10.30 a.m. to 6.00 p.m.		
" 26	0.23	Shower.	4.20 p.m. to 4.50 p.m.	" 6					
" 29	0.03	"	2.30 a.m. to 3.00 a.m.	" 7					
Total.	4.04			" 13	0.10	Mist.	9.30 p.m. to 2.30 a.m.		
				" 14					
July 4	0.20	Shower.	4.00 a.m. to 6.00 a.m.	" 29	0.12	Showers.	7.00 p.m. to 11.30 p.m.		
" 7	0.56	Rain.	1.30 p.m. to 5.30 a.m.	Total					
" 8					3.07				
" 15	0.07	Showers.	7.30 p.m. to 10.30 p.m.	Oct. 5	0.07	Rain.	6.30 a.m. to 11.50 a.m.		
" 18	0.30	Rain.	5.30 p.m. to 3.00 a.m.	" 7	2.45	"	6.20 p.m. to 7.00 a.m.		
" 19				" 8					
" 24	0.71	"	9.00 a.m. to 4.30 p.m.	" 11	0.02	Showers.	2.30 p.m. to 4.30 p.m.		
" 28	0.75	"	9.00 p.m. to 4.00 p.m.	" 13	1.33	Rain.	4.00 p.m. to 7.00 a.m.		
" 29				" 14					
" 30	0.85	"	8.30 p.m. to 2.00 a.m.	" 15	0.04	Shower.	1.00 p.m. to 3.00 p.m.		
" 31				" 20	1.04	Rain.	7.00 a.m. to 3.30 p.m.		
Total.	3.44			" 22	0.62	Rain and Snow.	4.00 p.m. to 11.00 a.m.		
				" 23					
Aug. 1	0.16	Rain.	9.30 p.m. to 1.00 a.m.	" 27	0.13	Rain.	7.15 a.m. to 6.30 p.m.		
" 2				Total.				5.70	
" 6	0.38	"	1.00 a.m. to 7.30 a.m.	Nov. 11	0.32	Rain.	11.45 a.m. to 6.30 p.m.		
" 7	0.26	Showers.	6.20 p.m. to 11.15 p.m.	" 16	0.93	"	6.30 p.m. to 2.00 a.m.		
" 12	0.32	Thunder showers.	2.45 p.m. to 3.30 p.m.	" 17					
" 15	0.60	Rain.	9.15 a.m. to 1.00 a.m.	" 18					
" 16				" 23	0.23	Showers.	6.30 a.m. to 9.30 p.m.		
" 21	0.63	"	10.45 p.m. to 9.30 a.m.						
" 22									

Table of Rainfall at Chestnut-Hill Reservoir. — *Concluded.*

DATE.	Inches.	Snow or Rain.	Duration.	DATE.	Inches.	Snow or Rain.	Duration.
Nov. 26	1.19	Rain.	6.00 p.m. to 4.00 a.m.	Dec. 24	0.65	Rain.	9.50 a.m. to 12.30 a.m.
" 27				" 25			
" 28	0.03	Mists.	5.30 a.m. to 6.30 a.m.	" 26	0.28	"	3.30 p.m. to 10.30 p.m.
				" 29	1.21	"	8.15 p.m. to 1.00 p.m.
Total.	2.70			" 30			
				Total.	3.73		
Dec. 4	0.36	Rain.	7.00 p.m. to 10.15 a.m.	Total rainfall for year, 49.63 inches.			
" 7	0.40	"	3.30 a.m. to 3.00 p.m.				
" 15	0.52	Snow and Rain.	4.30 a.m. to 9.00 a.m.				
" 16							
" 23	0.31	Rain.	2.00 a.m. to 12.30 p.m.				

REPORT OF THE ENGINEER.

CITY OF BOSTON,
ENGINEERING DEPARTMENT,
[50 CITY HALL, February 1, 1892.

MR. ROBERT GRANT, *Chairman Boston Water Board :*

SIR : In accordance with the requirements of the Revised Ordinances, I respectfully submit the following report on the condition of the Water-Works.

SOURCES OF SUPPLY.

The rainfall upon the water-sheds during the past year varied but little from the average amount, but less than the usual proportion fell during the summer and fall months, consequently the storage in the reservoirs began to be reduced in June and July, and steadily decreased until the latter part of December.

The rainfall and quantities collected on the several water-sheds were as follows :

	Sudbury.	Cochituate.	Mystic.
Rainfall in inches .	49.52	46.42	47.40
Rainfall collected, inches	27.612	32.07	28.60
Daily average yield of water - shed, gallons . . .	98,900,000	28,800,000	36,600,000

The quality of the water from all the supplies has been comparatively good.

The fluctuations in the amounts of water in the different lakes and reservoirs are shown graphically by an appended diagram.

The condition of the different reservoirs during the year is given below :

Reservoir No. 1. — Water was wasting at the dam from January 1 to July 2, with the exception of five days in May, after the stop-planks were placed on the dam, and during five

days in June. No water wasted over the dam after July 2, and only the one and one-half million gallons per day was allowed to flow through the waste-gates, as required by law.

The dam is in good condition.

Reservoir No. 2. — Water was flowing over the dam or through the gates of Dam 2 until May 9, when the flash-boards were placed in position. The reservoir filled to the top of the flash-boards four days later, but water was drawn from this reservoir to supply the city on the 14th, and the surface immediately fell below the top of the flash-board, and the reservoir did not fill again during the year. The lowest point reached was on August 19, when the surface was 9.48 feet below the top of the flash-boards.

The dam at Reservoir 2 is in good condition.

Reservoir No. 3. — This reservoir was full until the middle of August, except during February and March, when it was drawn down in anticipation of the usual large spring flow. On August 19 this reservoir was drawn from to supply the city, and its surface gradually fell until November 24, when it was at grade 162.32, or 12.92 feet below the crest of the overflow.

On Jan. 1, 1892, it had risen to 167.19, or 8.05 feet below the crest.

The dam at Reservoir 3 is in good condition.

Reservoir No. 4. — This reservoir was kept full until July 15, with the exception that it was lowered as usual in the spring.

On July 15 the outlet gate was partially opened to furnish a portion of the city's supply, and the reservoir gradually fell until September 26, when the gate was closed. The height at that date was 202.91, or 12.30 feet below the top of the flash-boards. Since that date no water has been drawn from the reservoir, and its surface has gradually risen. On January 1 its height was 207.85, or 6.36 feet below the crest of the dam.

The dam of Reservoir No. 4 is in good condition.

Farm Pond. — The surface of the pond has been kept at an average height of 149.12.

The conduit through the pond has been in use all the year, no water having been drawn from the pond to supply the city.

The Framingham Water Company has pumped 80,500,000 gallons from the pond, an average of 220,500 gallons per day.

Lake Cochituate. — Water was wasted from the outlet dam from January 2 to 7, and from January 12 to April 25.

The surface of the lake began to fall on April 26, and continued to fall slowly and with great regularity until

November 26, when it was at grade 126.44, or 7.92 feet below high-water, the lowest point during the year.

The lake began to fill during the latter part of December, and on January 1 it had risen to grade 127.34, or 7.02 feet below high-water line.

The heights of water in the various storage reservoirs on the first day of each month are given below :

	RESERVOIRS.				FARM POND.	LAKE COCHITU- ATE.
	No. 1.	No. 2.	No. 3.	No. 4.		
	Top of Flash- boards.	Top of Flash- boards.	Crest of Dam.	Top of Flash- boards.		
	159.29	167.12	175.24	215.21	149.25	134.36
January 1, 1891	157.66	165.96	175.32	214.41	149.36	132.49
February 1, "	158.23	166.13	175.36	210.11	149.17	133.14
March 1, "	158.27	166.20	175.45	210.77	149.90	132.75
April 1, "	158.07	166.27	175.42	211.97	148.97	134.14
May 1, "	157.77	166.00	175.34	214.53	149.39	134.12
June 1, "	159.37	166.10	175.41	214.74	149.26	133.20
July 1, "	159.37	165.37	175.36	214.81	149.09	132.22
August 1, "	157.68	160.36	175.31	211.56	148.89	130.71
September 1, "	157.89	159.33	174.02	206.21	148.93	129.48
October 1, "	157.59	158.93	172.12	202.91	148.79	128.30
November 1, "	157.25	159.08	167.70	203.97	148.81	127.06
December 1, "	157.00	160.80	163.50	205.46	148.80	126.69
January 1, 1892	157.20	163.55	167.19	207.85	148.99	127.34

Water has been drawn from the different reservoirs as follows :

RESERVOIR No. 1.

July 3 to 6, inclusive.

RESERVOIRS Nos. 1 AND 2.

July 2.

RESERVOIR No. 2.

May 17 to 24.

May 28 to June 7.

June 9 to 10.

June 16 to 18.

June 30 to July 1.

July 7 to Aug. 18.

Sept. 15 to 24.

Dec. 20 to 31.

RESERVOIRS NOS. 2 AND 3.

Jan. 1 to 4.	April 8 to 11.
Jan. 7 to 11.	April 16 to 18.
Jan. 15 to 18.	April 20 to 26.
Jan. 22 to 26.	April 30 to May 3.
Jan. 29 to Feb. 1.	May 7 to 9.
Feb. 5 to 8.	May 14 to 16.
Feb. 12 to 15.	May 25 to 27.
Feb. 19 to 23.	June 11 to 14.
Feb. 27 to March 1.	Aug. 19 to Sept. 14.
March 5 to 8.	Sept. 25 to Oct. 26.
March 12 to 15.	Oct. 28 to Nov. 16.
March 19 to 22.	Nov. 19 to 29.
March 26 to 28.	Dec. 1 to 19.
April 1 to 4.	

AQUEDUCTS AND DISTRIBUTING RESERVOIRS.

The Sudbury-river conduit has been used 298 days, and the Cochituate has been used 352 days. The Sudbury conduit has delivered 8,306,600,000 gallons into Chestnut-hill and Brookline reservoirs, equal to a daily supply of 22,760,000 gallons; the Cochituate aqueduct has delivered 5,508,180,000 gallons, or 15,091,000 gallons per day.

In the Cochituate aqueduct a nearly uniform depth of six and one-half feet was maintained until the middle of October, when the surface of the lake had fallen so low that this depth could not be maintained.

During the balance of the year the depth in the aqueduct closely followed the depth in the lake above the bottom of the aqueduct, and at one time it was only five feet four inches.

The rate of flow in the Sudbury conduit was varied almost daily to maintain the desired height in the distributing reservoirs. Both conduits were cleaned as usual during the year.

On April 19 one of the 40-inch siphon-pipes of the Cochituate aqueduct at Newton Lower Falls was split by the weight of gravel-filling that had been deposited over the pipes in building a new street across the location of the siphon. The water was shut off and the split pipe replaced before any damage had been done.

The Chestnut-hill, Brookline, Fisher-hill, Parker-hill, and East Boston reservoirs, and the Breed's Island water-tower, are in good condition. I recommend that the elm-trees at the base of the Chestnut-hill reservoir dam be removed. The inside of the iron water-tower on Bellevue hill should be painted this year.

The South Boston reservoir has not been in daily use for many years, but is kept partially full of water for use in special emergencies, and for this reason is still of value to the water-supply service. A check-valve should be placed in the high-service connection with this reservoir, to automatically supply the fire-hydrants within the high-service district of South Boston in case of serious fires.

HIGH-SERVICE PUMPING-STATIONS.

At Chestnut hill the pumping-engines and boilers are in excellent condition.

A permanent apparatus for weighing the feed-water has been placed in the boiler-room, and the accuracy of the feed-water meters is now easily ascertained from time to time, so that corrections can be made in calculating the efficiency of the boilers.

The table on page 108 shows in detail the work done by the pumping-engines and boilers during the year.

Engine No. 1 was used	3,419 $\frac{1}{4}$	
hours, pumping		1,264,475,610 gallons.
Engine No. 2 was used	3,768 $\frac{1}{4}$	
hours, pumping		1,386,688,800 "
Total amount pumped		2,651,164,410 "
Total amount coal consumed		2,910,751 pounds.
Percentage ashes and clinkers		8.5
Average lift in feet		124.6
Quantity pumped per lb. of coal		910.8 gallons.
Daily average amount pumped		7,263,500 "

The amount pumped is an increase of 11.9 per cent. over that of 1890.

The same boiler supplied steam for pumping, and for heating and lighting the pumping-station and other buildings near the station.

COST OF PUMPING.

Salaries	\$9,590 40
Fuel	6,558 28
Repairs	701 93
Oil, waste, and packing	534 51
Small supplies	257 18
Total	<hr/> \$17,642 30

Cost per million gallons raised one foot high	\$0.053
Cost per million gallons pumped to reservoir	6.65

At the West Roxbury pumping-station 24,108,000 gallons have been pumped, equivalent to a daily average of 66,000 gallons, — an increase of 68.4 per cent. over that pumped in 1890.

At the East Boston pumping-station an average of 13,500 gallons per day has been pumped into the Breed's Island water-tower.

Water was pumped into the East Boston reservoir only on two days in January, one day in February, and two days in March, as the reservoir could be filled during the night from the low-service mains during the balance of the year.

MYSTIC LAKE.

Water was wasted over the dam almost constantly until June 9, and again from June 22 to June 28. From this date the surface of the lake gradually fell until it was 7.67 feet below high-water on November 26, or only 3.50 feet above the bottom of the conduit. This was only about 4 inches above the point where the supply for the pumping-station could not be maintained by gravity.

Early in October the centrifugal pumps were placed in position at the lake to raise the water into the conduit, but fortunately it was not necessary to use them.

Advantage was taken of the low stage of the water to repaint the masonry at the overflow.

On January 1, 1892, the water in the lake had risen to grade 2.32, or 4.68 feet below high-water, and water was wasting over the dam on January 15.

The table on page 106 shows the yield of the water-shed. The rainfall there recorded is an average from two gauges, one located at the lake and one in Winchester.

The record of the latter gauge was kept by Mr. L. R. Symmes, formerly assistant superintendent, gratuitously until his death, last February. Since his death the gauge has been maintained and records kept by Miss A. F. Symmes.

MYSTIC VALLEY SEWER.

The pump was run 356 days during the year of 1891, working 6,391½ hours, and has pumped 119,404,000 gallons of sewage, or an average of 335,400 gallons per day of pumping. The amount pumped is only one-fourth of one per cent. greater than in 1890.

The total amount of sulphate of alumina used during the year was 303,780 pounds, and 173 tons of coal were used in pumping.

MYSTIC CONDUIT AND RESERVOIR.

The conduit was cleaned twice during the year, and is in good condition.

New sills and grooves for the screens should be placed in the screen-chamber, and the roof of the chamber should be raised to facilitate the changing of the screens. A new gate should be placed on the blow-off pipe, to exclude the tide-water.

The reservoir has not been cleaned for several years, otherwise it is in good condition.

MYSTIC PUMPING-STATION.

The pumps have received quite extensive repairs, and are in good condition.

The three older boilers should have new fronts, to correspond with those on the new boilers; a sluice-gate should be placed in the pump-well of Engine No. 3, as under the present condition any accident to the foot-valve of this pump would necessitate the stopping of the whole plant. A duplicate dynamo for lighting the building should be procured, and it would be an economical measure to build a new chimney of larger capacity if the plant is to be continued in service.

The table on page 109 shows in detail the work done by the pumping-engine during the year.

Engine No. 1 was in use	884	
hours, pumping	.	145,186,500 gallons.
Engine No. 2 was in use	1,774 $\frac{1}{4}$	
hours, pumping	.	346,862,000 "
Engine No. 3 was in use	8,352 $\frac{1}{2}$	
hours, pumping	.	2,812,902,400 "
Total amount pumped	.	3,304,951,000 "
Total amount coal consumed	.	6,988,500 pounds.
Percentage ashes and clinkers	.	10.2
Average lift in feet	.	148.02
Quantity pumped per lb. of coal	.	472.9 gallons.
Average duty of engine per 100		
lbs. of coal, no deductions	.	58,380,500 ft.-lbs.
Daily average amount pumped	.	9,054,700 gallons.

The amount pumped is an increase of 9.1 per cent. over that of 1890.

COST OF PUMPING.

Salaries	\$9,628 07
Fuel	13,946 42
Repairs	954 69
Oil, waste, and packing	983 96
Small supplies	444 89
Total	<u>\$25,958 03</u>
Cost per million gallons raised one foot high .	\$0.053
Cost per million gallons pumped to reservoir .	7.85

CONSUMPTION.

The daily average consumption from the combined works, and the consumption, compared with that of 1890, was as follows:

	COCHITUATE WORKS.		MYSTIC WORKS.		COMBINED SUPPLIES.	
	Consumption in Gallons.	Percentage of Consumption of 1890.	Consumption in Gallons.	Percentage of Consumption of 1890.	Consumption in Gallons.	Percentage of Consumption of 1890.
January	37,230,100	110.5	9,389,300	114.7	46,619,400	111.3
February	37,280,700	112.9	9,466,900	114.1	46,747,600	113.1
March	35,533,400	115.2	8,811,000	109.4	44,344,400	114.0
April	35,751,600	117.3	8,045,800	107.5	43,797,400	115.4
May	36,580,700	116.6	8,841,300	118.1	45,421,900	113.9
June	37,801,900	114.5	9,478,400	112.9	47,280,300	114.2
July	39,062,500	106.4	9,581,700	101.3	48,644,200	105.4
August	39,460,400	108.7	9,122,300	102.1	48,582,800	107.4
September	40,677,700	112.5	9,128,700	108.2	49,806,400	111.7
October	38,845,600	116.3	9,259,100	118.9	48,104,800	116.8
November	36,640,800	111.2	8,585,200	112.9	45,226,000	111.5
December	37,342,500	97.4	8,960,600	94.6	46,303,100	96.9
Average	37,686,900	111.3	9,055,200	109.1	46,742,100	110.8

The daily average consumption per head of population was as follows:

Sudbury and Cochituate supply,	89.3 gallons.
Mystic supply	74.7 “
Combined supplies	86.0 “

The above figures show an increase of 11.3 per cent. in the consumption supplied from the Sudbury and Cochituate works from that of the previous year; of 9.1 per cent. in the consumption supplied from the Mystic works; and of 10.8 per cent. increase in the consumption supplied by the combined supplies.

DEACON METERS.

There are now in use 81 meters, — 74 on the Cochituate system and 7 on the Mystic system, — and the territory covered by the meters is divided into 176 sections; 8 sections were not tested during the past year.

The quantity supplied to the entire residential portion of Boston can now be tested by the meters, excepting a portion of West Roxbury and that portion of the Back Bay district bounded by Boylston street, Parker street, and the Boston & Providence Railroad.

During the coming year two meters should be placed in the latter territory; but the West Roxbury district cannot be advantageously tested until the district is more densely populated.

On the Mystic system Charlestown is practically covered by meters; one meter covers a small portion of Somerville, and one about one-quarter of Chelsea. Everett has no meters.

The estimated population supplied with water, and the population that is covered by Deacon meters in the different sections of the city, is as follows:

SECTION.	Estimated Population.	Population on Meters.
City proper	164,875	132,000
Roxbury	104,000	84,000
West Roxbury	28,510	14,300
Dorchester	34,025	27,500
Brighton	13,700	5,400
South Boston	76,535	65,000
East Boston	41,375	32,000
Charlestown	45,930	32,500
Chelsea	33,775	9,300
Somerville	46,675	4,400

The consolidated results of the readings of the various sections is shown in the following table, in which is given the final reading of 1890, the first and last readings of this year, the differences between the first and second readings of this year, and the differences between the last readings of this year and those of 1890.

Cochituate System.

SECTION.	Population.	1890. 2d Reading.		1891. 1st Reading.		1891. 2d Reading.	
		Daily con.	Night rate.	Daily con.	Night rate.	Daily con.	Night rate.
City proper	132,000	52.5	29.4	56.9	35.3	61.7	37.5
Roxbury	84,000	49.2	28.8	58.1	36.4	53.5	36.8
West Roxbury	14,300	53.3	23.1	50.6	23.1	. . . . .	. . . . .
Dorchester	27,500	49.0	25.8	52.8	25.2	49.9	27.7
Brighton	5,400	52.1	24.0	61.3	27.1	. . . . .	. . . . .
South Boston	65,000	40.5	24.0	41.3	25.6	47.3	26.6
East Boston	32,000	34.5	20.2	35.7	24.2	39.9	25.6
	360,200	47.5	27.6	52.1	31.8	53.7	33.2

Mystic System.

Charlestown	32,500	33.8	17.8	40.6	24.0	41.5	25.2
Somerville	4,400	43.2	26.2	82.1	48.5	78.3	58.8
Chelsea	9,300	37.2	24.9	44.4	29.5	43.1	32.3
	46,200	35.3	20.0	45.1	27.3	45.2	29.6

ADDITIONAL SUPPLY.

At Dam No. 6 the excavation for the core-wall has been completed, the wall built in the trench, and the trench re-filled. This work was difficult; the building of the core-wall could not be done at a rapid rate, great care being necessary in removing the bracing and in doing the refilling.

The embankment and core-wall of the dam have been built to about five feet above the elevation of the lowest part of the valley, and the work is now in such condition that comparatively rapid progress can be made, all of the difficult work having been done.

The work of stripping the basin and the shallow-flowage work is well advanced. It will probably be completed this year.

The surveys of Cedar swamp, and the plans for its improvement, are practically completed. At Whitehall pond surveys and borings are being made for a new dam at the outlet; a dredging plant has been built, and the work of

removing mud and stumps from the bottom of the pond can be commenced in the spring.

On the Stony-brook branch of the Sudbury, surveys and borings are being made for Basins 5, 7, and 9, the construction of which must soon be commenced, as the increased consumption of water, due to the growth of the city, will keep pace with the increased capacity to be added by the completion of Basin No. 6.

For particulars see the following report of Desmond Fitzgerald, Resident Engineer :

BOSTON WATER-WORKS, OFFICE OF ADDITIONAL SUPPLY,
SOUTH FRAMINGHAM, MASS., Feb. 1, 1892.

WILLIAM JACKSON, Esq., *City Engineer* :

SIR : I submit herewith a brief report of engineering work accomplished during the past year by the "Additional Supply" force.

The name of Basin 5 has been changed to Basin 6, in order to bring all the even numbers on the Sudbury branch of the supply. Although the core-wall of this basin was heavily covered with hay, the frost got into the trench in January, 1891, and attacked the concrete, even at the bottom of the trench, 30 feet deep, necessitating the laying of steam-pipes. January 9 a contract was made with Charles H. Hale for delivering filling on the dam. April 6 the trench was uncovered and pumped out. May 5 the work of depositing concrete was begun. June 3 the core-wall was completed, and the back-filling begun, the sheeting being cut off in sections about 2 feet high, in order that the back-filling might be thoroughly rammed and bonded to the sides of the trench. On September 2 the back-filling reached the surface of the ground, and the embankment was begun. September 29 the contractor suspended operations, and on October 9 the work was continued by the bondsman, Mr. Barnabas Clark. The embankment has been built to the height of five feet above the meadow. A gap 20 feet wide was left in the core-wall to pass freshets during the winter and spring.

The gate-house for the 48-inch pipe has been built and the pipe laid on rock foundation and covered with brickwork. It discharges into the wasteway, the lower section of which has been built. The upper gate-house has been begun. All gate-house, pipe, and core-wall trenches have been back-filled.

May 25 a contract was made with Charles H. Hale for building the lower section of the wasteway, 220 feet long, and on September 24 the work was completed.

July 14 four sections for stripping the bottom of the basin were let, and about two-fifths of this work has been done in a satisfactory and economical manner.

During the latter part of the summer a railroad was built connecting the Boston & Albany R.R. with the basin. After its completion about 25,000 cubic yards of loam were hauled to the Muddy-river Improvement on behalf of the town of Brookline.

The principal specifications and contracts prepared during the year were those for the stripping and shallow flowage, the railroad, and the lower section of the wasteway. The following table shows the work accomplished thus far at the new basin :

WORK DONE AT BASIN 6 DURING 1890 AND 1891.

	1890.	1891.
Clearing	19 acres.	23 acres.
Stripping earth (city contract)	47,891 cu. yds.	50,940 cu. yds.
Stripping earth (contract),	0 "	175,000 "
Stripping rock	2,125 "	536 "
Collecting stone	15,953 "	4,423 "
Trench excavation, earth .	19,450 "	4,641 "
Trench excavation, rock .	1,018 "	1,051 "
Crushing stone	6,857 "	2,994 "
Concrete	7,179 "	2,498 "
Plaster	2,174 "	2,132 "
Back-filling	507 "	10,875 "
Embankment	5,362 "	15,928 "
Screening sand and gravel,	4,221 "	2,751 "
Rubble-stone delivered .	19 "	466 "
Stone-masonry	0 "	534 "
Brick-masonry	35 "	291 "
Delivering clay (city labor),	0 "	593 "
Laying 48-inch pipe . . .	0 lin. ft.	414 lin. ft.
Laying 36-inch pipe . . .	0 "	12 "
Loaming embankment . . .	0 c. y.	322 c. y.
Wasteway	0 lin. ft.	220 lin. ft.

Surveys have been continued on various portions of the water-shed. The work of lining the Beacon-street tunnel has been prosecuted from Dec. 30, 1890, to May 14, 1891. The cost of laying the concrete was \$13.14 this year against \$15.02 last year.

Yours very truly,

(Signed)

DESMOND FITZGERALD,

Resident Engineer.

IN GENERAL.

The sewerage system of the city of Marlboro' is well advanced, the main sewer is completed, the filtration areas are prepared, and a considerable portion of the service-sewers are laid. The system will be in operation early this year, and it will greatly improve the quality of the water collected by the Stony-brook branch of the Sudbury river.

The sewerage system of the town of Westboro' is under construction, and will probably be in operation in the near future.

Work has been begun upon the foundations of the new pumping-engine at Chestnut-hill pumping-station, and the plans for the engine are nearly completed.

The daily amount pumped at this station increases about 12 per cent. each year, and will exceed the nominal capacity of one pumping-engine next year; consequently the work on the new engine must be pushed as rapidly as possible.

At the Mystic station the pumps are duplicated to a capacity of 10,000,000 gallons per day, and at the present rate of increase the daily average consumption in 1893 will exceed this amount.

In this connection I wish to call attention to the fact that the total capacity of the Mystic system is but 7,000,000 gallons daily in a dry year, and to recommend that the dependant municipalities make some provision to meet the inevitable deficiency which must sooner or later occur.

Thirty-seven contracts for rock excavation have been made during the year. Two hundred and ninety-nine petitions for main-pipe extensions have been reported upon in regard to grade of street, size of pipe, and cost of laying.

The pipe laid has been measured, the gates and hydrants located, and are being plotted on the plans.

Thirty-five profiles of unaccepted streets have been made, and grades given for grading the streets and laying pipes where it was necessary.

The records from the four pumping-stations, the lakes, reservoirs, the Mystic sewer, and the returns from pipe foundries, etc., have been carefully kept.

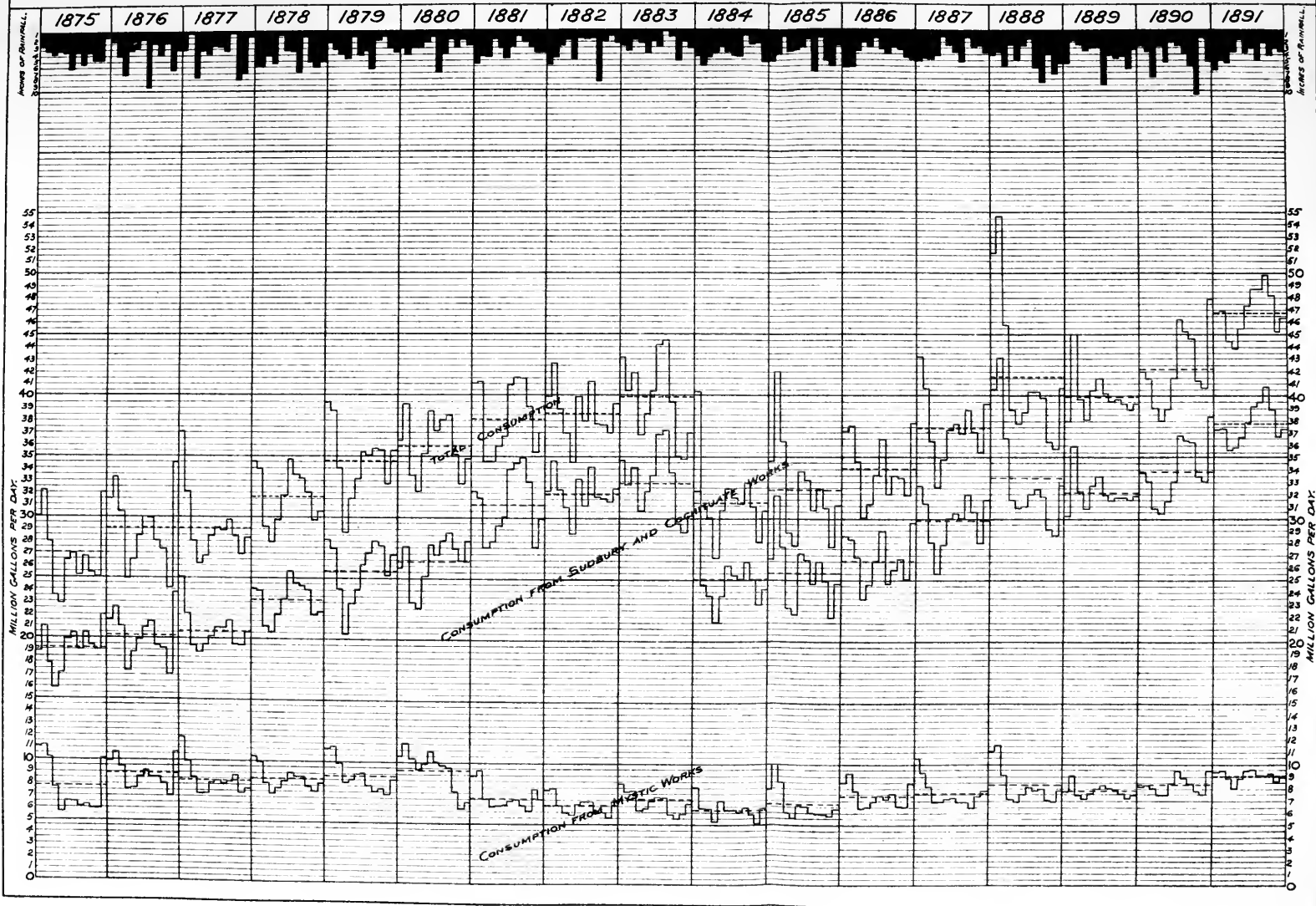
Appended to this report will be found the usual tables of rainfall, consumption, yield of water-sheds, etc.

WILLIAM JACKSON,
City Engineer.

BOSTON WATER WORKS.

Diagram showing the rainfall and daily average Consumption for each month.

Yearly Averages shown thus -----



Daily Average Consumption of Water, in Gallons, from the Cochituate and Mystic Works.

MYSTIC WORKS.													
	1885.	1886.	1887.	1888.	1889.	1890.	1891.						
January	26,711,900	28,561,900	32,687,600	40,485,700	30,172,000	33,680,000	37,230,100						
February	31,847,400	28,291,100	31,224,300	43,105,000	35,855,200	33,030,700	37,280,700						
March	27,697,200	26,886,800	28,124,100	36,463,400	32,180,000	30,844,400	35,533,400						
April	22,720,450	23,470,400	25,391,500	31,473,800	30,814,500	30,446,600	35,751,600						
May	22,168,400	24,680,100	27,925,000	30,801,000	32,719,500	31,381,200	36,580,700						
June	27,214,800	26,574,900	30,069,000	31,026,100	33,377,900	33,022,700	37,801,900						
July	26,606,200	28,987,500	30,469,700	32,014,100	31,870,300	36,701,100	39,062,600						
August	24,686,400	24,770,600	30,063,100	32,432,700	31,403,200	36,316,000	39,460,400						
September	26,493,600	25,835,600	31,946,600	31,836,500	31,722,800	36,165,800	40,677,700						
October	24,945,500	26,713,100	30,562,700	29,110,800	31,702,200	33,429,800	38,845,600						
November	21,942,750	25,036,200	28,062,000	28,590,900	31,532,400	32,955,100	36,640,800						
December	24,724,900	29,706,800	31,511,500	32,686,200	31,829,000	38,334,100	37,342,500						
Yearly average .	25,607,200	26,627,900	29,852,100	33,310,700	32,070,000	33,871,700	37,686,900						

COCHITUATE WORKS.													
MONTH.	1885.	1886.	1887.	1888.	1889.	1890.	1891.						
January	26,711,900	28,561,900	32,687,600	40,485,700	30,172,000	33,680,000	37,230,100						
February	31,847,400	28,291,100	31,224,300	43,105,000	35,855,200	33,030,700	37,280,700						
March	27,697,200	26,886,800	28,124,100	36,463,400	32,180,000	30,844,400	35,533,400						
April	22,720,450	23,470,400	25,391,500	31,473,800	30,814,500	30,446,600	35,751,600						
May	22,168,400	24,680,100	27,925,000	30,801,000	32,719,500	31,381,200	36,580,700						
June	27,214,800	26,574,900	30,069,000	31,026,100	33,377,900	33,022,700	37,801,900						
July	26,606,200	28,987,500	30,469,700	32,014,100	31,870,300	36,701,100	39,062,600						
August	24,686,400	24,770,600	30,063,100	32,432,700	31,403,200	36,316,000	39,460,400						
September	26,493,600	25,835,600	31,946,600	31,836,500	31,722,800	36,165,800	40,677,700						
October	24,945,500	26,713,100	30,562,700	29,110,800	31,702,200	33,429,800	38,845,600						
November	21,942,750	25,036,200	28,062,000	28,590,900	31,532,400	32,955,100	36,640,800						
December	24,724,900	29,706,800	31,511,500	32,686,200	31,829,000	38,334,100	37,342,500						
Yearly average .	25,607,200	26,627,900	29,852,100	33,310,700	32,070,000	33,871,700	37,686,900						

Statement showing Amount of Water diverted from Sudbury River to Lake Cochituate and Chestnut-Hill Reservoir; Amount wasted; Amount of Flow in River; Percentage of Rainfall collected, etc., 1875 to 1891.

(Water-shed from 1875 to 1878, inclusive, = 77,764 sq. miles; in 1879 and 1880 = 78,238 sq. miles; and from 1881 to 1891, inclusive, = 75.2 sq. miles.

YEAR.	Amount of Water diverted to Lake Cochituate and Chestnut-Hill Reservoir.	Amount of Water used by Framingham Water Co.	Amount of Water wasted from River.	STORAGE.		Total amount of flow in River.	Daily average amount of flow in River.	Rainfall.	Rainfall collected.	Percentage of Rainfall collected.
				Gain.	Loss.					
	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Inches.	Inches.	Per cent.
1875	2,555,800,000	. . . . .	24,971,600,000	66,300,000	. . . . .	27,503,700,000	75,593,200	45.490	20.418	44.88
1876	2,525,300,000	. . . . .	29,942,300,000	. . . . .	160,700,000	32,309,900,000	88,275,400	49.563	23.908	48.24
1877	1,894,350,000	. . . . .	32,438,300,000	112,100,000	. . . . .	34,444,750,000	94,369,200	44.018	25.487	57.90
1878	3,422,100,000	. . . . .	37,125,200,000	654,700,000	. . . . .	41,202,000,000	112,882,200	57.931	30.487	52.63
1879	3,749,200,000	. . . . .	20,317,500,000	962,200,000	. . . . .	25,528,900,000	69,942,200	41.419	18.775	45.33
1880	6,230,200,000	. . . . .	11,290,000,000	. . . . .	958,600,000	16,561,600,000	42,250,300	38.177	12.182	31.91
1881	8,345,300,000	. . . . .	17,279,000,000	751,700,000	. . . . .	26,876,000,000	73,633,900	44.169	20.565	46.56
1882	7,735,200,000	. . . . .	16,273,900,000	. . . . .	352,800,000	23,656,600,000	64,812,300	39.394	18.102	45.95
1883	8,455,000,000	. . . . .	7,251,900,000	. . . . .	1,086,400,000	14,620,500,000	40,056,200	32.780	11.188	34.13
1884	6,110,900,000	. . . . .	23,228,000,000	1,744,600,000	. . . . .	31,084,100,000	84,929,200	47.135	23.784	50.46
1885	5,224,700,000	61,800,000	19,873,800,000	. . . . .	446,900,000	24,718,400,000	67,721,600	43.545	18.916	43.44
1886	5,266,600,000	76,600,000	23,023,000,000	1,464,500,000	. . . . .	29,831,700,000	81,730,700	46.065	22.825	49.55
1887	6,124,100,000	87,500,000	25,334,500,000	117,400,000	. . . . .	31,668,500,000	86,749,300	42.705	24.227	56.73
1888	7,224,700,000	61,500,000	39,040,500,000	390,600,000	. . . . .	46,717,300,000	127,642,900	57.465	35.749	62.21
1889	6,323,900,000	59,500,000	31,550,400,000	. . . . .	2,800,000	37,971,000,000	104,030,100	49.95	29.056	58.17
1890	6,596,000,000	74,500,000	28,667,100,000	. . . . .	57,400,000	35,280,200,000	96,668,100	53.00	26.998	50.94
1891	8,306,600,000	80,500,000	28,799,600,000	. . . . .	1,100,800,000	36,085,900,000	98,865,500	49.52	27.612	55.76
Averages .	5,684,332,400	71,700,000	24,524,100,000	. . . . .	. . . . .	30,361,361,800	82,949,600	46.019	22.957	49.10

Statement showing Amount of Water drawn from Lake Cochituate ; Amount wasted ; Amount of Rainfall collected in Lake ; Amount received into Lake from Sudbury River ; Percentage of Rainfall collected, etc., 1852 to 1891 ; Water-shed of Lake, 12,077 Acres.

YEAR.	Amount of Water drawn from Lake.	Amount of Water wasted from Lake.	Amount received into Lake from Sudbury River.	STORAGE.		Total amount of Rainfall collected in Lake.	Daily average amount of Rain- fall collected in Lake.	Rainfall. Inches.	Rainfall collected. Inches.	Percentage of Rainfall collected.
				Gain.	Loss.					
	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Inches.	Inches.	Per cent.
1852 ¹	2,971,042,800	4,020,566,900	.....	.....	261,360,000	6,733,249,700	18,396,900	47.93	20.61	48.
1853	3,117,939,500	3,166,417,500	.....	239,580,000	.....	6,523,937,000	17,873,800	55.73	19.51	35.
1854	3,614,230,000	4,187,733,000	.....	.....	217,800,000	7,584,163,000	20,778,500	43.15	22.87	53.
1855	3,776,399,500	No account kept	.....	.....	326,700,000	.....	.....	34.96	.....	.....
1856	4,409,787,600	"	.....	598,950,000	.....	.....	.....	40.80	.....	.....
1857	4,644,990,000	10,625,900,000	.....	32,670,000	.....	15,303,560,000	41,927,600	63.10	46.69	74.
1858	4,689,155,000	1,934,500,000	.....	.....	141,570,000	6,482,085,000	17,759,000	48.66	19.46	40.
1859 ²	4,808,875,000	7,569,000,000	.....	283,140,000	.....	12,661,015,000	34,687,700	49.02	38.24	78.
1860	6,309,108,000	None.	.....	174,240,000	.....	6,483,348,000	17,714,100	55.44	19.40	35.
1861	6,639,065,900	3,377,559,000	.....	.....	1,459,260,000	8,537,394,900	23,444,900	45.44	25.45	56.
1862	6,659,010,000	33,200,000	.....	1,306,800,000	.....	7,399,003,000	20,271,200	49.69	22.36	45.
1863	5,927,052,500	2,165,696,500	.....	762,300,000	.....	8,855,049,000	24,260,400	69.30	26.88	39.
1864	6,103,306,700	1,363,746,000	.....	.....	1,848,577,000	5,625,475,700	15,370,200	42.60	18.35	43.
1865	4,621,630,000	1,688,120,700	.....	743,242,500	.....	7,052,993,200	19,323,300	40.46	20.50	41.
1866	4,463,585,000	None.	.....	743,242,500	.....	5,206,827,500	14,265,300	62.32	16.01	26.
1867	4,951,225,000	2,482,041,000	.....	.....	698,811,000	6,734,455,000	18,450,600	56.25	21.80	39.
1868	5,405,515,000	2,507,684,000	.....	346,371,000	.....	8,253,570,000	22,567,200	49.71	24.98	50.

1869	5,503,751,000	1,635,570,000	.....	480,882,000	.....	7,620,203,000	20,877,300	64.34	21.99	34.
1870	5,477,810,000	4,818,971,000	.....	.....	1,736,083,000	8,560,696,000	23,453,900	55.89	26.08	47.
1871	5,223,500,900	None.	.....	.....	250,933,000	4,972,567,000	13,623,500	45.39	15.16	33.
1872	5,775,151,200	None.	.....	.....	.....	5,642,480,300	15,416,600	48.47	17.22	35.
1873	6,511,826,900	2,917,977,000	.....	1,543,995,500	.....	8,914,671,900	24,423,800	45.43	27.13	60.
1874	6,623,972,900	1,145,851,700	.....	.....	.....	6,402,109,600	17,540,000	35.93	19.52	54.
1875	7,092,955,500	None.	.....	.....	.....	5,760,040,500	15,780,900	45.49	17.57	39.
1876	7,277,175,200	1,619,243,800	.....	2,555,800,000	.....	6,411,557,000	17,517,900	48.49	19.54	40.
1877	7,620,889,200	1,484,978,600	.....	2,528,300,000	.....	7,586,244,800	20,811,000	43.80	23.17	53.
1878	7,743,904,700	3,341,875,000	.....	1,894,350,000	.....	8,637,268,700	23,663,700	53.55	26.34	49.
1879	6,051,838,900	1,523,361,400	.....	2,665,300,000	.....	5,841,203,000	16,003,300	38.01	17.81	47.
1880	4,284,147,100	65,577,700	.....	411,300,000	.....	3,376,759,800	9,226,100	35.83	10.30	29.
1881	2,846,456,700	2,231,016,700	.....	826,700,000	.....	5,357,965,800	14,679,400	41.09	16.34	40.
1882	3,935,490,600	1,358,543,700	.....	187,600,000	.....	4,936,699,600	13,525,200	40.29	15.95	37.
1883	4,731,227,700	162,361,800	.....	.....	.....	3,314,089,500	9,079,700	31.20	10.11	32.
1884	4,533,156,450	1,842,837,100	.....	1,245,100,000	.....	6,300,130,250	17,213,450	45.57	19.21	42.
1885	4,001,674,900	1,006,622,800	.....	1,416,500,000	.....	5,106,892,500	13,991,500	43.66	15.57	36.
1886	4,432,536,100	3,116,283,200	.....	.....	.....	7,188,157,300	19,693,600	46.97	21.92	47.
1887	4,802,120,700	3,658,652,900	.....	.....	.....	7,697,568,600	21,089,200	41.58	23.47	56.
1888	4,965,503,100	4,229,200,000	.....	.....	.....	10,157,012,100	27,751,400	56.93	30.97	54.
1889	5,570,425,600	3,373,923,000	.....	233,400,000	.....	9,165,719,400	25,711,600	50.23	27.95	56.
1890	5,729,170,800	2,380,441,200	.....	.....	.....	8,038,445,700	22,023,100	51.23	24.51	48.
1891	5,563,175,900	6,064,000,000	.....	.....	.....	10,516,121,100	28,811,300	46.42	32.07	69.
Averages	5,221,293,100	2,450,125,200	.....	.....	.....	7,288,861,200	19,958,000	47.98	22.16	46.

¹ Observation of rainfall at Lake Cochituate commenced 1852, and these observations are assumed as correct for the whole district.

² Lake raised two feet.

showing Amount of Water drawn from Mystic Lake; Amount wasted; Amount of Rainfall collected in Lake; Percentage of Rainfall collected, etc., 1876 to 1891; Watershed of Lake, 17,200 Acres.

YEAR.	Amount of Water drawn from Lake.	Amount of Water wasted from Lake.	STORAGE.		Total amount of Rainfall collected in Lake.	Daily average amount of Rainfall collected in Lake.	Rainfall.	Rainfall collected.	Percentage of Rainfall collected.
			Gain.	Loss.					
	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Inches.	Inches.	Per cent.
1876	3,220,101,300	6,389,774,700	. . . . .	32,583,000	9,567,293,000	26,140,100	47.00	20.49	43.6
1877	3,069,554,800	7,250,223,500	. . . . .	16,291,400	10,303,486,800	28,223,700	43.095	22.06	51.2
1878	3,367,490,400	8,718,547,600	. . . . .	28,000,000	12,090,038,000	33,041,200	64.065	25.82	47.8
1879	3,490,845,200	4,625,691,800	. . . . .	203,000,000	7,913,540,000	21,680,900	35.30	16.94	48.0
1880	3,692,195,700	2,158,761,200	. . . . .	113,500,000	5,703,756,900	15,584,000	34.42	12.21	35.5
1881	2,815,575,900	5,534,300,000	371,200,100	. . . . .	8,721,079,900	23,893,400	41.91	18.67	44.5
1882	2,570,896,700	4,444,668,000	15,000,000	. . . . .	7,030,564,700	19,261,800	39.165	15.05	38.4
1883	2,664,514,200	2,084,702,600	. . . . .	347,579,000	4,351,637,800	11,923,300	31.22	9.32	29.84
1884	2,469,761,000	6,574,003,800	380,600,000	. . . . .	9,424,364,800	25,749,600	44.39	20.18	45.46
1885	2,639,278,800	5,558,860,500	. . . . .	33,200,000	8,194,939,300	22,451,900	44.50	17.55	39.43
1886	2,862,947,500	7,743,258,900	. . . . .	28,400,000	10,577,806,400	25,980,300	45.56	22.65	49.71
1887	2,954,251,500	7,414,213,000	. . . . .	11,000,000	10,357,470,500	28,376,600	46.42	22.17	47.77
1888	3,205,421,100	11,384,593,100	. . . . .	6,000,000	14,533,714,200	39,709,600	56.745	31.12	54.84
1889	3,007,539,800	8,879,787,500	12,000,000	. . . . .	11,899,327,300	32,600,900	50.395	25.48	50.56
1890	3,212,384,500	8,953,727,900	. . . . .	3,000,000	12,163,012,400	33,323,300	49.37	26.04	52.75
1891	3,700,817,500	10,027,714,400	. . . . .	171,000,000	13,357,531,900	36,600,000	47.40	28.60	60.34
Average	3,047,074,300	6,728,301,800	. . . . .	. . . . .	9,759,972,800	26,721,500	44.435	20.90	46.23

=====

MONTH:

January
February
March .
April . .
May . .
June . .
July . .
August .
Septembe
October .
November
December
Yearly averages

=====

BOSTON WATER WORKS.

Diagram showing the heights of Sudbury River Reservoirs, Farm Pond, and Cochituate and Mystic Lakes, and the Rainfall on the Sudbury River Water Shed during the year 1891.

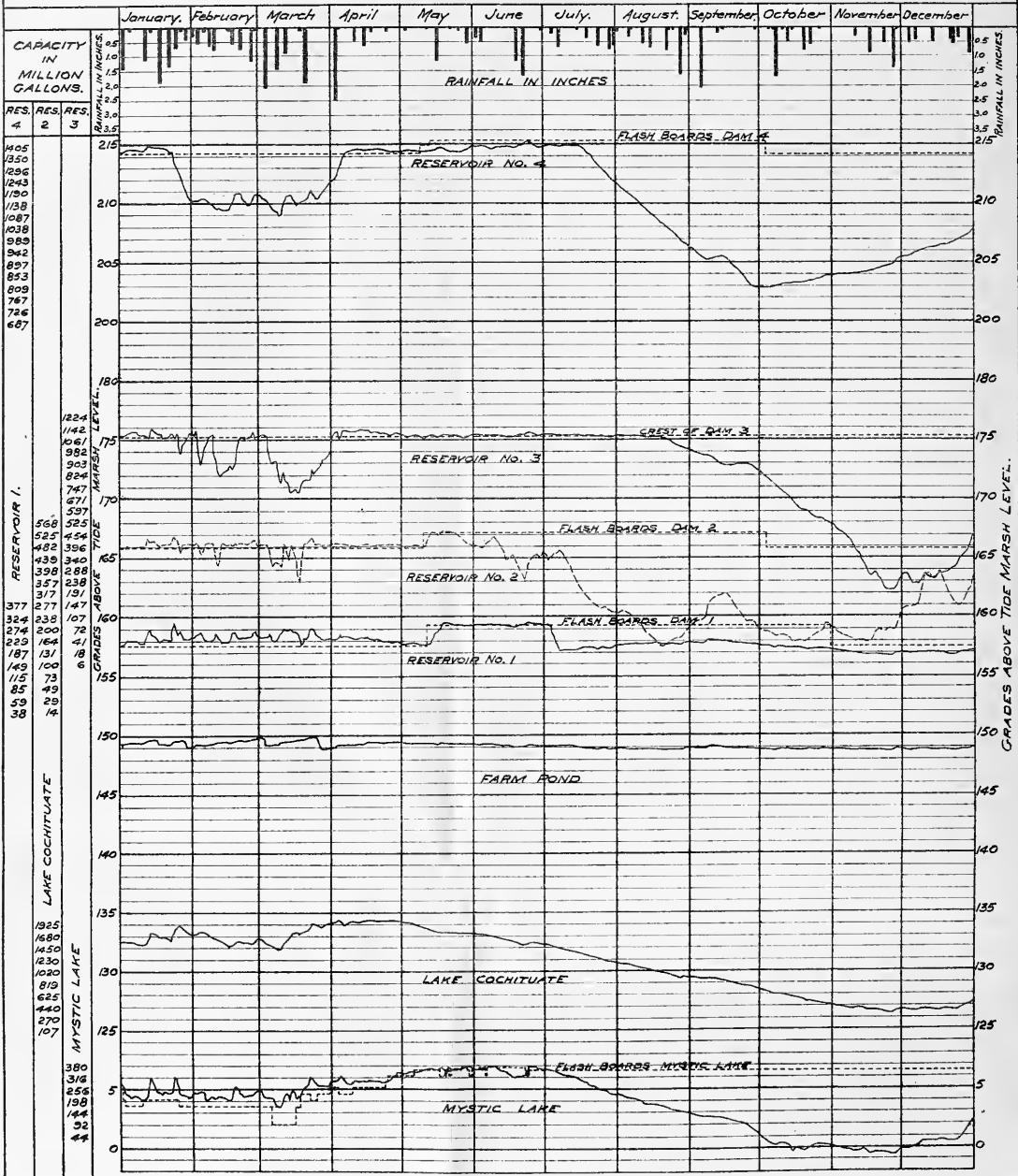


Table showing the Average Monthly and Yearly Heights above Tide-marsh Level of the Water in the Lakes and Reservoirs of the Boston Water Works.

MONTHS.	Reservoir No. 1. Flash boards. 159.29.		Reservoir No. 2. Flash boards. 167.12.		Reservoir No. 3. Stone crest. 175.24.		Reservoir No. 4. Flash boards. 215.21.		Farm Pond. High water. 149.25.		Lake Cochituate. High water. 134.36.		Chestnut-Hill Reservoir. High water. 124.00.		Brookline Reservoir. High water. 124.00.		Parker-Hill Reservoir. High water. 219.00.		Mystic Lake. High water. 7.00.		Mystic Reservoir. High water. 147.00.		Fisher-Hill Reservoir. High water. 241.00.	
	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.
January .	157.95	158.23	166.12	166.20	175.55	175.32	214.53	213.85	149.64	149.48	132.49	132.05	123.45	123.48	123.02	123.25	218.78	218.78	4.75	4.75	146.75	149.66	239.22	240.12
February .	157.99	158.33	166.15	166.06	175.57	174.41	214.54	210.14	149.27	149.53	132.38	132.73	123.42	123.43	123.24	123.20	218.48	218.77	5.44	4.56	146.77	146.87	239.47	240.22
March . .	158.30	158.45	164.63	165.57	173.92	172.73	213.53	210.35	149.54	149.50	132.30	133.13	123.43	123.27	123.27	123.06	218.75	218.75	5.15	4.79	146.81	146.85	239.01	240.34
April . . .	158.09	158.15	166.18	166.12	175.56	175.59	214.59	214.25	149.29	149.33	133.03	134.23	123.47	123.52	123.31	123.32	218.63	218.76	5.93	5.81	146.61	146.63	239.04	240.17
May . . .	157.96	158.64	166.57	166.59	175.56	175.30	214.54	214.50	149.60	149.32	133.82	133.56	123.79	123.47	123.45	123.02	218.49	218.71	6.44	6.71	146.55	146.52	239.00	240.00
June . . .	158.80	159.36	167.18	165.36	175.45	175.37	214.71	214.84	149.59	149.17	133.56	132.68	123.79	123.70	123.61	123.47	218.36	218.71	6.55	6.38	146.43	146.57	239.48	240.10
July . . .	159.09	157.57	162.37	162.79	175.17	175.30	213.90	214.07	149.15	148.96	131.99	131.44	123.81	123.76	123.58	123.50	218.65	218.83	5.73	5.02	146.69	146.90	239.89	240.60
August . .	158.67	157.77	160.86	158.86	174.21	175.00	208.51	208.92	148.85	148.83	130.34	130.04	123.82	123.86	123.59	123.58	218.90	218.90	3.82	3.07	146.82	146.93	239.67	240.46
September,	157.63	157.88	164.02	160.47	175.14	173.17	202.33	204.72	149.07	148.94	129.55	129.02	123.77	123.69	123.54	123.43	218.76	218.67	3.31	2.29	146.70	146.84	239.59	240.35
October . .	157.99	157.44	165.85	158.51	175.02	169.84	205.15	203.35	149.54	148.81	130.38	127.67	123.86	123.69	123.53	123.43	218.96	218.69	4.68	0.20	146.58	146.56	240.05	240.61
November .	157.92	156.97	166.13	158.64	175.52	164.60	212.53	204.41	149.19	148.75	132.47	126.71	123.88	123.82	123.68	123.31	218.89	218.60	5.65	—	0.30	146.61	240.29	240.73
December .	157.84	157.00	166.09	162.15	175.47	164.03	214.13	206.51	149.26	148.84	132.64	126.72	123.53	123.73	123.03	123.51	218.74	218.91	5.48	0.68	146.70	146.84	239.82	240.62
Yearly averages }	158.19	157.98	165.18	163.11	175.23	172.34	211.92	209.09	149.33	149.12	132.08	130.91	123.67	123.62	123.40	123.54	218.69	218.76	5.31	3.78	146.67	146.78	239.55	240.36

Statement of Operations at the Chestnut-Hill Pumping-Station for 1891.

1891.	Engine No. 1.		Engine No. 2.		Total amount pumped.	Daily average amount pumped.	Total amount of coal consumed.	Daily average amount of coal consumed.	Total ashes and clinkers.	Per cent. ashes and clinkers.	Quantity pumped per lb. of coal, No correction for heating and lighting.	Quantity pumped per lb. of coal, Corrected for heating and lighting.	Average lift in feet.	Duty in ft.-lbs. per 100 lbs. of coal.			Water evaporated in boiler per lb. of coal.
	Mins.	Gallons.	Mins.	Gallons.										Without correction for heating and lighting.	Corrected for heating and lighting.	Corrected for heating and lighting.	
Month.	Mins.	Gallons.	Mins.	Gallons.	Gallons.	Gallons.	Lbs.	Lbs.	Lbs.	Per Cent.	Gallons.	Gallons.	Feet.	Ft.-lbs.	Ft.-lbs.	Ft.-lbs.	Lbs.
Jan. . . .	596	188,962	596	209,531	125	6,750	245,844	7,930	21,504	8.7	852.3	957.1	123.86	87,899,100	93,436,700	98,669,200	10.26
Feb. . . .	533	188,962	533	188,962	250	6,748	216,763	7,742	18,568	8.6	871.7	975.4	124.05	90,188,900	95,780,600	100,932,800	10.28
March . . .	579	205,505	579	205,505	850	6,629	235,933	7,611	20,706	8.8	871.0	964.2	124.72	90,602,000	95,404,500	100,269,200	10.17
April . . .	539	197,856	539	197,856	500	6,595	220,362	7,345	19,419	8.8	897.9	972.4	124.24	93,033,900	96,383,100	100,729,300	10.26
May	620	221,006	620	221,006	625	7,129	240,462	7,577	20,988	8.7	919.1	974.2	124.35	95,317,190	97,509,400	101,010,700	10.20
June	633	230,849	633	230,849	300	7,035	237,339	7,911	19,623	8.3	972.7	1004.8	123.85	100,460,600	103,782,000	106,299,000	11.88
July	629	237,948	629	237,948	475	7,675	248,637	8,021	19,474	7.8	956.9	986.6	124.72	99,537,000	102,622,600	104,497,700	12.12
Aug. . . .	617	234,275	617	234,275	135	7,557	241,270	7,783	18,919	7.8	971.0	1009.8	124.55	100,863,200	104,897,700	107,624,600	12.09
Sept. . . .	495	190,820	495	190,820	750	8,920	232,335	8,411	20,965	8.3	953.6	994.6	124.93	99,352,400	102,622,600	106,824,600	12.07
Oct.	619	237,324	619	237,324	550	7,655	258,957	8,353	22,310	8.6	916.5	974.2	125.32	95,785,900	97,031,100	101,785,600	10.49
Nov.	532	221,711	532	221,711	675	7,390	246,894	8,228	21,578	8.7	898.2	976.3	125.43	93,061,800	96,780,700	102,103,600	10.40
Dec.	596	225,577	596	225,577	650	7,273	265,995	8,580	24,517	9.2	848.1	923.6	125.42	88,706,500	91,456,400	96,578,000	10.31
Totals and averages,	5419	1,261,475	5419	1,386,688	800	7,263	2,910,751	7,975	248,565	8.5	910.8	975.5	124.60	94,048,900	97,015,100	101,380,800	10.34

Statement of Operations at the Mystic Pumping-Station for 1891.

Statement of Operations at the																					
1891.	ENGINE NO. 1.				ENGINE NO. 2.				ENGINE NO. 3.				Total amount pumped.		Daily average amount of coal consumed.	Daily average amount of ashes and clinkers.	Per cent. ashes and clinkers.	Quantity pumped coal.	Average lift in feet.	Duty in foot-pounds per 100 coal.	
	Total pumping-time.		Amount pumped.	Total pumping-time.		Amount pumped.	Total pumping-time.		Amount pumped.	Gallons.	Gallons.	Gallons.	Gallons.								
	Hrs.	Min.		Hrs.	Min.		Hrs.	Min.						Hrs.							Min.
Month.	Hrs.	Min.	Gallons.	Hrs.	Min.	Gallons.	Hrs.	Min.	Gallons.	Hrs.	Min.	Gallons.	Hrs.	Min.	Gallons.	Lbs.	Lbs.	Per ct.	Gal.	Feet.	Ft.-lbs.
January . . . . .	...	...	...	201	15	37,659,400	744	00	253,772,800	291,432,200	9,401,000	20,206	2,065	10.2	463.0	147.39	56,908,400				
February . . . . .	...	...	...	159	00	30,094,300	672	00	235,008,000	265,102,300	9,467,900	19,821	2,026	10.2	477.7	147.17	58,628,100				
March . . . . .	...	...	...	106	45	21,019,200	733	00	252,339,200	273,358,400	8,818,000	17,968	1,871	10.4	490.8	146.66	60,028,200				
April . . . . .	...	...	...	...	...	...	720	00	240,691,200	240,691,200	8,023,000	16,400	1,597	9.7	489.2	146.24	59,666,100				
May	29	15	5,390,700	66	00	17,470,700	730	00	251,827,200	274,688,600	8,860,900	18,258	1,836	10.1	485.2	146.99	59,494,700				
June	288	45	48,954,200	439	00	92,004,300	443	45	143,001,600	283,960,100	9,465,300	21,750	2,228	10.2	435.2	147.97	53,705,200				
July	8	15	1,615,700	237	45	46,643,900	734	15	249,164,800	297,424,400	9,594,300	20,097	2,120	10.6	477.4	148.30	59,046,700				
August	19	30	3,790,100	155	30	29,173,200	744	00	249,625,600	282,588,900	9,115,800	18,581	1,924	10.4	490.6	148.42	60,728,300				
September	168	45	30,592,600	62	00	12,517,900	692	30	230,604,800	273,715,300	9,123,800	19,133	2,007	10.5	476.9	148.56	59,082,000				
October	289	30	54,843,200	41	45	8,471,100	676	30	224,153,600	287,467,900	9,273,200	20,129	2,084	10.4	460.7	149.47	57,428,100				
November . . . . .	...	...	...	131	30	24,190,200	720	00	232,524,800	256,715,000	8,557,200	18,067	1,863	10.3	473.6	149.81	59,177,800				
December . . . . .	...	...	...	146	45	27,617,900	742	30	250,188,800	277,806,700	8,961,500	19,274	1,900	9.9	464.9	149.27	57,882,000				
Totals and averages }	884	00	145,186,500	1,777	15	346,862,100	8,352	30	2,812,902,400	3,304,951,000	9,054,700	19,147	1,960	10.2	472.9	148.92	58,380,500				

Rainfall in Inches and Hundredths on the Sudbury River Water-shed for the Year 1891.

1891.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1.		0.340						0.130				
2.	1.425					0.385						
3.		0.545		2.480	0.100							
4.			2.065	0.010		0.500	0.225					0.565
5.	0.105									0.115		
6.		0.155						0.345	2.040			
7.							0.715	0.070		0.020		0.415
8.		0.650								1.695		
9.			1.455									
10.		0.770										
11.				0.480						0.065	0.320	
12.	1.130				0.070			0.525				
13.			0.900						0.190	0.495		
14.	0.035											
15.				0.635			0.020	0.730	0.070	0.020		0.475
16.		0.070			1.160							
17.		0.120									0.830	
18.	1.875	0.550		0.160								
19.			0.110			1.195	0.355					
20.										0.770		
21.		0.750	1.945									
22.	1.295				0.030	1.675		0.810				
23.								0.110		0.575	0.500	0.380
24.							0.655					0.640
25.	0.725			0.140				0.010				
26.		1.185			0.100							0.330
27.	0.040									0.085	1.400	
28.		0.100						1.645			0.040	
29.	0.390				0.550		0.785		0.080			
30.						0.015		0.285				0.880
31.							0.640	0.065				
Totals. .	7.020	5.235	6.475	3.905	2.010	3.770	3.395	4.725	2.380	3.830	3.090	3.685

Total rainfall during the year, 49.520 inches, being an average of two gauges, located at Framingham and Ashland.

Rainfall in Inches and Hundredths at Lake Cochituate for the year 1891.

1891.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1.		0.34						0.12				
2.	1.33					0.53						
3.		0.42		2.40	0.12							
4.			1.63			0.33	0.18					0.38
5.	0.21									0.35		
6.		0.13						0.49	1.77			
7.							0.64	0.01				0.22
8.		0.70								1.78		
9.			1.26									
10.		0.80										
11.				0.39						0.07	0.31	
12.	1.01				0.06			0.77				
13.			0.76						0.23	0.53		
14.	0.03											
15.				0.60			0.03	0.61	0.04	0.03		0.54
16.		0.03			0.82							
17.											0.81	
18.	2.00	0.59		0.16	0.01							
19.			0.08			1.02	0.34					
20.										0.65		
21.		0.71										
22.	1.05		1.76			1.87		0.76				
23.								0.03		0.60	0.37	0.32
24.							0.68					
25.	0.67			0.07								
26.		1.17			0.15							0.91
27.	0.02									0.11	1.33	
28.		0.13						1.83	0.08		0.02	
29.	0.35					0.03	0.58					
30.					0.51							0.80
31.							0.54	0.29				
Totals . .	6.67	5.02	5.49	3.62	1.67	3.73	2.99	4.91	2.12	4.14	2.84	3.17

Total rainfall during the year, 46.42 inches.

Rainfall in Inches and Hundredths on the Mystic Lake Water-shed for the Year 1891.

1891.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1		0.540						0.025				
2	1.130					0.305						
3		0.480		2.135	0.120	0.395	0.005					
4			1.920			0.015	0.185					0.365
5	0.145									0.195		
6		0.215						0.585	1.825		0.005	
7					0.020		0.710	0.130				0.260
8		0.680								1.595		
9			0.905									
10		0.785										
11				0.285						0.035	0.380	
12	1.035							0.025				
13			0.880		0.045				0.225			
14	0.020									1.155		
15				0.495			0.035	0.750		0.050		0.575
16					1.445							
17		0.445							0.015		0.520	
18	1.475			0.145								
19			0.105			1.540	0.325					
20										1.075		
21		0.740	2.230						0.015			
22	1.030				0.115	2.155		0.530				
23			0.030							0.460	0.265	0.380
24							0.410	0.010				0.540
25	1.010	0.010		0.090								
26		1.060			0.075							0.350
27	0.030									0.170	1.405	
28		0.120				0.010		1.470			0.030	
29	0.370				0.630	0.010	0.655		0.080			
30							0.855					0.940
31					0.010			0.355				
Totals . .	6.245	5.075	6.070	3.150	2.460	4.430	3.180	3.880	2.160	4.735	2.605	3.410

Total rainfall during the year, 47.400 inches, being an average of two gauges, located at Mystic Lake and Winchester.

Monthly Rainfall in Inches, during 1891, at Various Places in Eastern Massachusetts.

PLACE.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Lake Cochituate	6.67	5.02	5.49	3.62	1.67	3.78	2.99	4.91	2.12	4.14	2.84	3.17	46.42
Framingham	6.92	5.12	6.63	3.76	2.17	3.37	3.07	5.22	2.35	3.70	3.04	3.76	49.11
Dam 4, Ashland	7.12	5.35	6.32	4.05	1.85	4.17	3.72	4.23	2.41	3.96	3.14	3.61	49.93
Chestnut Hill	6.43	5.34	5.63	2.98	2.05	4.04	3.44	4.04	3.05	5.70	2.70	3.73	49.63
Mystic Station, Winchester	6.20	5.17	5.95	2.80	2.37	4.33	3.20	3.66	2.01	4.53	2.43	3.20	45.85
Mystic Lake	6.29	4.98	6.19	3.50	2.55	4.53	3.16	4.10	2.31	4.94	2.78	3.62	45.95
Mystic Pumping station	5.99	4.85	5.68	2.85	2.31	4.09	3.29	3.72	2.67	5.05	2.50	3.45	46.45
Boston Pipe-yard	6.11	5.27	5.35	2.53	2.69	2.86	3.18	3.74	1.58	5.50	2.65	3.66	45.12
Cambridge Observatory	6.09	4.55	4.90	2.44	2.10	3.57	2.93	3.21	2.63	4.82	2.22	3.29	42.76
Waltham, Boston Manufacturing Co.	5.71	4.83	5.96	3.14	1.93	4.02	2.83	5.32	2.53	4.34	2.67	3.90	47.18
Lowell, Locks and Canals Co.	7.041	4.841	6.004	3.564	2.289	3.659	3.169	2.144	1.787	2.926	1.918	3.204	42.546
Lowell, Merrimac Manufacturing Co.	6.62	2.631	4.202	2.80	1.96	3.20	2.62	1.885	1.295	2.60	0.93	3.09	33.833
Average of twelve places	6.474	4.820	5.692	3.169	2.162	3.802	3.133	3.848	2.228	4.351	2.485	3.474	45.648

Rainfall Received and Collected 1891.

MONTH.	SUDBURY.			COCHITUATE.			MYSTIC.		
	Rainfall.	Rainfall collected.	Per cent. collected.	Rainfall.	Rainfall collected.	Per cent. collected.	Rainfall.	Rainfall collected.	Per cent. collected.
	Inches.	Inches.	Per cent.	Inches.	Inches.	Per cent.	Inches.	Inches.	Per cent.
January . .	7.020	5.383	76.69	6.67	6.26	93.81	6.245	6.286	100.67
February . .	5.235	5.616	107.28	5.02	6.62	131.93	5.075	5.969	117.61
March . . .	6.475	7.944	122.69	5.49	8.03	146.26	6.070	7.208	118.74
April . . .	3.905	4.138	105.97	3.62	4.31	119.15	3.150	3.434	109.01
May	2.010	1.039	51.70	1.67	0.88	52.75	2.460	1.402	57.01
June . . .	3.770	0.714	18.92	3.78	0.77	20.36	4.430	1.010	22.80
July	3.395	0.266	7.83	2.99	0.50	16.65	3.180	0.422	13.27
August . .	4.725	0.290	6.15	4.91	0.72	14.69	3.880	0.439	11.31
September .	2.380	0.350	14.71	2.12	0.76	35.91	2.160	0.417	19.32
October . .	3.830	0.375	9.78	4.14	0.79	18.95	4.735	0.575	12.14
November .	3.090	0.526	17.03	2.84	0.83	29.21	2.605	0.565	21.68
December .	3.685	0.971	26.34	3.17	1.60	50.47	3.410	0.873	25.59
Totals and averages }	49.520	27.612	55.76	46.42	32.07	69.08	47.400	23.600	60.34

Table showing the Temperature of Air and Water at Various Stations on the Water- Works.

1891.	TEMPERATURE OF AIR.						TEMPERATURE OF WATER.	
	Chestnut-Hill Reservoir.			Framingham.			Brookline Reservoir.	Mystic Engine-House.
	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.	Mean.	Mean.
January	54.0	9.0	29.3	51.0	0.0	28.3	36.3	34.0
February . . .	62.0	2.0	31.5	62.0	-1.0	31.1	36.0	34.1
March	54.0	0 0	33.8	51.0	0.0	32.9	37.1	35.2
April	78.0	24.0	49.5	77.0	24.0	49.0	48.8	48.3
May	88.5	30.0	57.2	85.0	30.0	57.3	57.0	58.1
June	96.0	42.5	65.9	96.0	38.0	65.4	65.1	68.2
July	90.5	51.0	68.6	89.0	46.0	67.5	71.5	70.7
August	90.0	47.5	70.2	94.0	45.0	69.4	73.6	74.5
September . . .	90.0	47.0	67.2	88.0	44.0	65.4	69.7	69.3
October	86.0	23.5	51.0	84.0	26.0	48.6	58.2	59.5
November . . .	66.0	9.5	41.4	66.0	6.0	39.0	44.6	44.7
December . . .	64.0	12.0	39.2	67.0	8.0	37.8	38.2	39.2

REPORT OF THE SUPERINTENDENT OF THE MYSTIC DIVISION.

ROBERT GRANT, Esq., *Chairman Boston Water Board*:

SIR: The report of the Mystic Division of the Boston Water-Works, from Jan. 1, 1891, to Feb. 1, 1892, is herewith submitted.

MYSTIC LAKE.

Mystic lake was nearly full until the last of June, when it began to fall until November 26. It was then 7.67 feet below high-water mark. On January 1, it had filled to within 4.68 feet below high-water, and was wasting over the flash-boards January 15.

The stonework at the dam has been pointed and the wooden bridge rebuilt. The bridge across the Abbajona river, known as Bacon's bridge, has been replanked with 3-inch planks. A wooden fence 865 feet long has been built on the Arlington road, leading to the lake, and a telephone placed in the gate-keeper's house. At the engine-houses, stone foundations have been laid for the boilers, and the floors newly timbered and planked. The engines, boilers, and pumps have been overhauled and thoroughly repaired. The usual work of removing the *algæ* from Horn and Wedge ponds, and that section of the river above Whitney's dam, has been done. Taking advantage of the lowness of the water during the early fall, we have cleansed and in some places gravelled portions of the beds of the lake, ponds, and feeders.

MYSTIC RESERVOIR.

Five hundred and fifty feet of the road leading to the pumping-station have been macadamized and 638 feet of wooden fence built. All the seats along the walk on top of the reservoir have been repaired, and some repairs have been made in and about the gate-house. The banks have been top-dressed, and the adjoining roads have received the customary care. The basins will be cleaned and repaired during the coming spring.

CONDUIT.

The conduit has been cleaned and flushed twice in the past year and a few defects remedied.

FORCE-MAINS.

A new check-valve has been placed in the 30-inch main connected with Engine No. 3 and a 2-inch blow-off put on the main connected with the effluent chamber.

PUMPING-STATION.

Engines Nos. 1 and 2 have been furnished with new valve-rods, and Engine No. 1 has had a new set of water-valves attached. The boiler-pumps have been thoroughly overhauled and repaired, and the doors of boilers Nos. 1, 2, and 3 have had improved fire-proof linings affixed. All the boilers have been cleaned and inspected, and, at present, boilers Nos. 4, 5, and 6 are again laid up for the same purpose. Much-needed sanitary improvements have been made in the basement of the engine-house. Engines Nos. 1, 2, and 3 and the engine-room have been painted, and the grounds adjacent to the engine-house have been kept in good condition.

MYSTIC-VALLEY SEWER.

The quantity of sewage pumped during the thirteen months has been 133,102,028 gallons, to which was applied as a precipitant 331,890 lbs. of crude sulphate of alumina. The quantity of sludge precipitated, and also pumped, was 2,953,611 gallons. This sludge in its fluid condition contained at least 96 per cent. moisture, and before it became sufficiently hard to handle by excavation it lost 84 per cent. of its original moisture. The sludge in this semi-state contained moisture to the amount of 75 per cent. of its bulk; and 2,334 cubic yards of it was removed from the settling basins. A large proportion of this sludge was carted away by a neighboring farmer, who used it as a fertilizer. The rate of application of precipitant, during the time covered by this report, was 1 part to 3,354 parts of sewage, or 1.24 tons per 1,000,000 gallons of sewage. The amount of coal used was 210.66 tons.

In May, a new centrifugal pump of larger size was substituted for the old sewage pump. A movable cage, for intercepting large pieces of floating matter in the sewage, has been fitted to the gate-frame of one of the sewer manholes near the works. This has proved of great benefit by retaining considerable hair and leather which otherwise would have passed to the sewage pump, and thereby have had a tendency to clog it. The roadway has been improved and two new sludge-basins built. A stone foundation has been laid for the boiler, a few slight repairs have been made on the

pumps, a new smoke-stack erected, and new belting substituted.

The plant is in good condition, with the exception of the flume, which conveys the sewage to the several tanks, and the sludge-gates in the tank building; but in the coming spring the necessary repairs will be made.

POLLUTION INSPECTION.

Many of the landlords and householders along the supply have been interviewed, and most of them have displayed a willingness to comply with our requirements. One hundred and eighty old cases and 155 new cases have been inspected; 37 cesspools and 12 vaults have been cleaned, to prevent overflowing; 20 new cesspools and 3 vaults built; 28 drains and 3 vaults abandoned; 16 manure-piles, 23 sinks, 11 water-closets, and 2 urinals removed. In the case of the last three items the fixtures have been arranged to discharge into the Woburn city drain, which connects with Mystic sewer.

An experiment to filter the sewage at Dow's tannery, Woburn, has met with fair success. The sewage from this establishment contains a large quantity of lime and grease, which must be removed before the effluent water is applied to the filter; and if these substances can be eliminated, the desired result will probably be obtained.

FILTRATION EXPERIMENTS.

An experimental station for filtering Mystic water has been established at West Medford, near the pumping-station. The results obtained thus far, both by the continuous and the intermittent methods of filtering, show that a continuation of the experiments will be required, in order to give results from which positive conclusions may be drawn.

DISTRIBUTION-PIPES.

The distribution-pipes have been extended by the addition of 452 feet of 8-inch pipe, 591 feet of 6-inch pipe, and 105 feet of 4-inch pipe. There have been 4,597 feet of cement-lined pipes replaced by cast-iron pipes.

There are remaining in the Charlestown District 9,900 feet of cement-lined distribution-pipes, varying from 2 inches to 20 inches.

HYDRANTS AND GATES.

Seven new hydrants, 4 street Lowry hydrants, and 4 Post hydrants have been established. Twelve street Lowry hydrants have been abandoned and new ones substituted. One flush hydrant has been replaced by a street Lowry hydrant. Fifteen additional gates have been established: 1 sixteen-inch gate, 3 twelve-inch gates, 1 eight-inch gate, 8 six-inch gates, and 2 four-inch gates.

FOUNTAINS AND STAND-PIPES.

One new drinking-fountain has been erected on Monument square, and 8 additional stand-pipes, for street-watering carts, have been established.

SERVICE-PIPES AND BOXES.

Eighty-two new services have been laid and 135 services repaired, for which 3,009 feet of lead pipe and 1,148 feet of cast-iron pipe were required. Thirty-six one-half inch, and 2 five-eighths inch tin-lined services have been removed and larger pipes substituted. Twenty-one wooden service-boxes have been replaced by iron boxes. Ten leaks have been repaired, and 42 stoppages by eels, 12 by rust, and 19 by moss, have been blown out.

New Services.

Size	$\frac{5}{8}$ -in.	$\frac{3}{4}$ -in.	1 in.	2-in.	6 in.	Total number.	Total ft.
Number	51	11	4	12	4	82	2,318

Summary of Services connected with Works, Feb. 1, 1892.

	Charlestown.	Somerville.	Chelsea.	Everett.	Total.
Number of services	5,987	6,953	5,231	2,387	20,558
Number of feet	160,069	232,852	140,856	47,598	581,375

Breaks and Leaks on Distribution-Pipes.

Size of Pipes	3 in.	4-in.	6-in.	8-in.	10-in.	Total.
Charlestown . . . . .	...	...	1	...	...	1
Chelsea	2	21	6	1	4	34
Somerville . . . . .	...	22	12	1	...	35

Distribution-Pipes Relaid.

LOCATION.	Original Size.	6-in.	8-in.	10-in.	12 in.	14-in.	18-in.	20-in.	Total.
Caldwell street	6-in.	. . .	280	. . .	. . .	. . .	. . .	. . .	280
Main street, Rider Pipe . .	6-in.	. . .	88	. . .	. . .	. . .	. . .	. . .	88
Sever street	4-in.	680	. . .	. . .	. . .	. . .	. . .	. . .	680
Main street, Rider Pipe . .	6-in.	216	. . .	. . .	. . .	. . .	. . .	. . .	216
Main street, Rider Pipe . .	8-in.	202 $\frac{1}{2}$	. . .	. . .	. . .	. . .	. . .	. . .	202 $\frac{1}{2}$
Medford street	6-in.	72	. . .	. . .	. . .	. . .	. . .	. . .	72
Medford street	12-in.	. . .	. . .	. . .	1,506	. . .	. . .	. . .	1,506
Prescott street	6-in.	400 $\frac{1}{2}$	. . .	. . .	. . .	. . .	. . .	. . .	400 $\frac{1}{2}$
Pleasant street	4-in.	170	. . .	. . .	. . .	. . .	. . .	. . .	170
School street	4-in.	337	. . .	. . .	. . .	. . .	. . .	. . .	337
Charles-street court . . .	3-in.	306	. . .	. . .	. . .	. . .	. . .	. . .	306
Charles street	4-in.	339 $\frac{1}{2}$	. . .	. . .	. . .	. . .	. . .	. . .	339 $\frac{1}{2}$
Chelsea	4-in.	2,363	. . .	. . .	. . .	. . .	. . .	. . .	2,363
Chelsea	3-in.	135	. . .	. . .	. . .	. . .	. . .	. . .	135
Chelsea	6-in.	564	. . .	. . .	. . .	. . .	. . .	. . .	564
Somerville	4-in.	305	. . .	. . .	. . .	. . .	. . .	. . .	305
Somerville	6-in.	2,032	. . .	. . .	. . .	. . .	. . .	. . .	2,032
Somerville	8-in.	. . .	2,906	. . .	. . .	. . .	. . .	. . .	2,906
Somerville	10-in.	. . .	. . .	227	. . .	. . .	. . .	. . .	227
Somerville	12-in.	. . .	. . .	. . .	2,024	. . .	. . .	. . .	2,024
Somerville	14-in.	. . .	. . .	. . .	. . .	1,793	. . .	. . .	1,793
Somerville	18-in.	. . .	. . .	. . .	. . .	. . .	700	. . .	700
Somerville	20-in.	. . .	. . .	. . .	. . .	. . .	. . .	743	743
Everett	10-in.	. . .	. . .	178	. . .	. . .	. . .	. . .	178
Everett	6-in.	. . .	227	. . .	. . .	. . .	. . .	. . .	227
Everett	6-in.	196	. . .	. . .	. . .	. . .	. . .	. . .	196
Everett	4-in.	589	. . .	. . .	. . .	. . .	. . .	. . .	589
Everett	8-in.	. . .	2,778	. . .	. . .	. . .	. . .	. . .	2,778
									22,357 $\frac{1}{2}$

Extension of Distribution-Pipes.

SIZE OF PIPES.	2-in.	3-in.	4-in.	6-in.	8-in.	10-in.	Total.
Main and Alford sts., Rider Pipe				98	236		
Caldwell street					216		
Hayes court, off Everett street			105				
Shurtleff court				48			
Spice street				445			
Somerville	1,233		647	8,049	3,502	730	
Chelsea			129	120			
Everett			4,576	9,915	1,362		
	1,233		5,457	18,675	5,316	730	31,411

Length of Distributing-Mains connected with Works Feb. 1, 1892.

	DIAMETER.										
	3-in.	4-in.	6-in.	8-in.	10-in.	12-in.	14-in.	16-in.	18-in.	20-in.	TOTAL.
Charlestown . . .	2,400	24,425	62,402	22,406	5,606	15,087	. . . . .	20,140	. . . . .	6,180	201,898
Somerville	7,456	90,594	164,766	49,078	11,081	9,154	8,037	. . . . .	387	. . . . .	340,552
Chelsea	18,313	77,014	38,970	7,787	26,653	. . . . .	. . . . .	2,348	. . . . .	. . . . .	171,085
Everett	914	51,581	57,506	4,043	7,128	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	121,172
Total	29,082	243,614	323,644	83,304	50,468	24,241	8,037	22,488	387	6,180	834,707

Number of Gates connected with Works Feb. 1, 1892.

Charlestown . . .	12	165	207	56	17	37	25	. . . . .	. . . . .	4	11	12	. . . . .	546
Somerville	5	225	314	27	22	23	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	616
Chelsea	30	179	64	22	19	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	314
Everett	4	85	106	10	8	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	213
Total	51	654	691	115	66	60	25	. . . . .	. . . . .	4	11	12	. . . . .	1,689

Hydrants Established.

	ESTABLISHED.			ABANDONED.	Net Increase.
	Lowry.	Boston Lowry.	Post.	Flush.	
Charlestown	5	.....	4	1	8
Somerville . . . . .	.....	.....	31	.....	31
Chelsea . . . . .	.....	.....	.....	.....	.....
Everett . . . . .	.....	.....	26	.....	26
Total	5	.....	61	1	65

Total Number of Hydrants in use Feb. 1, 1892.

Charlestown	198	33	54	38	323
Somerville	2	.....	465	.....	467
Chelsea . . . . .	.....	.....	184	2	186
Everett	1	.....	123	.....	129
Medford . . . . .	.....	.....	2	6	8
Pumping-Station . . . . .	.....	.....	2	1	3
Total	201	33	835	47	1,116

Respectfully submitted,

EUGENE S. SULLIVAN,

Superintendent.

SUMMARY OF STATISTICS.

REPORT OF 1891.

IN ACCORDANCE WITH THE RECOMMENDATION OF THE NEW
ENGLAND WATER-WORKS ASSOCIATION.

Boston Water-Works, Suffolk County, Massachusetts,
supplies also the cities of Somerville and Chelsea, and the
town of Everett.

Population by census of 1890 :

Boston	448,477
Chelsea	27,909
Somerville	40,152
Everett	11,068
Total	527,606

Date of construction :

Cochituate Works	1848
Mystic "	1864

By whom owned. — City of Boston.

Sources of supply. — Lake Cochituate, Sudbury river, and
Mystic lake.

Mode of supply. — Sixty-five per cent. from gravity works.
Thirty-five " " " pumping "

PUMPING.

	COCHITUATE.	MYSTIC.
Builder of pumping machinery	Holly Co.	H. R. Worthington.
Description of coal used :		
a Kind	Bituminous.	Bituminous.
c Size	Broken.	Broken.
e Price per gross ton, in bins, . . .	\$4.90.	\$4.34.
f Per cent. of ash, . .	8.5.	10.2.

	COCHITUATE.	MYSTIC.
Coal consumed for year, in lbs.	2,910,751	6,988,500
Total pumpage for year, in gallons	2,651,164,400	3,304,951,000
Average dynamic head, in feet	124.60	148.02
Gallons pumped per lb. of coal	910.8	472.9
Duty in foot-lbs. per 100 lbs. of coal	101,380,800	58,380,500
Cost of pumping figured on pumping-station expenses, viz.:	\$17,642 30	\$25,958 02
Cost per million gallons raised to reservoir	\$6 65	\$7 85
Cost per million gallons raised one foot high	\$0.053	\$0.053

CONSUMPTION.

	COCHITUATE.	MYSTIC.
Estimated population	422,100	121,200
Estimated population supplied	417,000	120,000
Total consumption, gallons, 13,755,735,400	3,305,139,500	
Passed through meters	3,717,945,000	673,625,900
Average daily consumption, gallons	37,686,900	9,055,200
Gallons per day, each inhabitant	89.3	74.7
Gallons per day, each consumer	90.4	75.5
Gallons per day to each tap,	599	440

DISTRIBUTION.

Mains.

	COCHITUATE.	MYSTIC.
Kind of pipe used	{ Cast-Iron.	Cast-Iron, Wrought-Iron and Cement.
Sizes	48-in. to 4-in.	30-in. to 3-in.
Extended, miles	20.	5.8
Total now in use	519.	158.
Distribution-pipes less than 4-in., length miles	0	5.5
Hydrants added	247	65

	COCHITUATE.	MYSTIC.
Hydrants now in use . .	5,684	1,116
Stop-gates added . .	289	114
Stop-gates now in use .	5,691	1,689

Services.

Kind of pipe used .	{	Lead.	Lead and Wrought-Iron.
Sizes . . . .	.	$\frac{5}{8}$ -in. to 4-in.	$\frac{1}{2}$ -in. to 2-in.
Extended, feet . . .	.	64,224	28,695
Service-taps added . .	.	2,159	1,036
Total now in use . .	.	62,877	20,556
Meters added . . . .	.	212	15
Meters now in use . .	.	3,839	406
Motors and elevators in use,		518	21

CIVIL ORGANIZATION OF THE WATER-WORKS, FROM THEIR COMMENCEMENT TO JANUARY 1, 1892.

WATER COMMISSIONERS.

NATHAN HALE,† JAMES F. BALDWIN,‡ THOMAS B. CURTIS. From May 4, 1846, to January 4, 1850.

ENGINEERS FOR CONSTRUCTION.

JOHN B. JERVIS, of New York, Consulting Engineer. From May, 1846, to November, 1848.‡

E. S. CHESBROUGH, Chief Engineer of the Western Division. From May, 1846, to January 4, 1850.‡

WILLIAM S. WHITWELL, Chief Engineer of the Eastern Division. From May, 1846, to January 4, 1850.

ENGINEERS HAVING CHARGE OF THE WORKS.

E. S. CHESBROUGH, Engineer. From November 18, 1850, to October 1, 1855.‡

GEORGE H. BAILEY, Assistant Engineer. From January 27, 1851, to July 19, 1852.

H. S. MCKEAN, Assistant Engineer. From July 19, 1852, to October 1, 1855.‡

JAMES SLADE, Engineer. From October 1, 1855, to April 1, 1863.‡

N. HENRY CRAFTS, Assistant Engineer. From October 1, 1855, to April 1, 1863.

N. HENRY CRAFTS, City Engineer. From April 1, 1863, to November 25, 1872.

THOMAS W. DAVIS, Assistant Engineer. From April 1, 1863, to December 8, 1866.

HENRY M. WIGHTMAN, Resident Engineer at C. H. Reservoir. From February 14, 1866, to November, 1870.‡

A. FTELEY, Resident Engineer on construction of Sudbury-river works. From May 10, 1873, to April 7, 1880.

JOSEPH P. DAVIS, City Engineer. From Nov. 25, 1872, to March 20, 1880.

HENRY M. WIGHTMAN, City Engineer. From April 5, 1880, to April 3, 1885.‡

WILLIAM JACKSON, City Engineer. From April 21, 1885, to present time.

DESMOND FITZGERALD, Resident Engineer on Additional Supply. From February 20, 1889, to present time.

After January 4, 1850, Messrs. E. S. CHESBROUGH, W. S. WHITWELL, and J. AVERY RICHARDS were elected a Water Board, subject to the direction of a Joint Standing Committee of the City Council, by an ordinance passed December 31, 1849, which was limited to keep in force one year; and in 1851 the Cochituate Water Board was established.

COCHITUATE WATER BOARD.

Presidents of the Board.

THOMAS WETMORE, elected in 1851, and resigned April

7, 1856† Five years

JOHN H. WILKINS, elected in 1856, and resigned June 5, 1860†	Four years.
EBENEZER JOHNSON, elected in 1860, term expired April 3, 1865†	Five years.
OTIS NORCROSS, elected in 1865, and resigned January 15, 1867†	One year and nine months.
JOHN H. THORNDIKE, elected in 1867, term expired April 6, 1868†	One year and three months.
NATHANIEL J. BRADLEE, elected April 6, 1868, and resigned January 4, 1871†	Two years and nine months.
CHARLES H. ALLEN, elected January 4, 1871, to May 4, 1873	Two years and four months.
JOHN A. HAVEN, elected May 4, 1873, to Dec. 17, 1874†	One year and seven months.
THOMAS GOGIN, elected Dec. 17, 1874, and resigned May 31, 1875	Six months.
L. MILES STANDISH, elected August 5, 1875, to July 31, 1876†	One year.

Members of the Board.

THOMAS WETMORE, 1851, 52, 53, 54, and 55†	Five years.
JOHN H. WILKINS, 1851, 52, 53, *56, 57, 58, and 59†	Eight years.
HENRY B. ROGERS, 1851, 52, 53, *54, and 55†	Five years.
JONATHAN PRESTON, 1851, 52, 53, and 56†	Four years.
JAMES W. SEAVER, 1851†	One year.
SAMUEL A. ELIOT, 1851.†	
JOHN T. HEARD, 1851†	One year.
ADAM W. THAXTER, Jr., 1852, 53, 54, and 55†	Four years.
SAMPSON REED, 1852 and 1853†	Two years.
EZRA LINCOLN, 1852†	One year.
THOMAS SPRAGUE, 1853, 54, and 55†	Three years.
SAMUEL HATCH, 1854, 55, 56, 57, 58, and 61	Six years.
CHARLES STODDARD, 1854, 55, 56, and 57†	Four years.
WILLIAM WASHBURN, 1854 and 55†	Two years.
TISDALE DRAKE, 1856, 57, 58, and 59†	Four years.
THOMAS P. RICH, 1856, 57, and 58†	Three years.
JOHN T. DINGLEY, 1856 and 59†	Two years.
JOSEPH SMITH, 1856†	Two months.
EBENEZER JOHNSON, 1857, 58, 59, 60, 61, 62, 63, and 64†	Eight years.
SAMUEL HALL, 1857, 58, 59, 60, and 61†	Five years.
GEORGE P. FRENCH, 1859, 60, 61, 62, and 63†	Five years.
EBENEZER ATKINS, 1859†	One year.
GEORGE DENNIE, 1860, 61, 62, 63, 64, and 65	Six years.
CLEMENT WILLIS, 1860†	One year.
G. E. PIERCE, 1860†	One year.
JABEZ FREDERICK, 1861, 62, and 63†	Three years.
GEORGE HINMAN, 1862 and 63	Two years.
JOHN F. PRAY, 1862†	One year.
J. C. J. BROWN, 1862	One year.
JONAS FITCH, 1864, 65, and 66†	Three years.
OTIS NORCROSS, *1865 and 66†	Two years.
JOHN H. THORNDIKE, 1864, 65, 66, and 67†	Four years.
BENJAMIN F. STEVENS, 1866, 67, and 68	Three years.
WILLIAM S. HILLS, 1867	One year.
CHARLES R. TRAIN, 1868†	One year.
JOSEPH M. WIGHTMAN, 1868 and 69†	Two years.
BENJAMIN JAMES, *1858, 68, and 69	Three years.
FRANCIS A. OSBORN, 1869	One year.
WALTER E. HAWES, 1870†	One year.

JOHN O. POOR, 1870	One year.
HOLLIS R. GRAY, 1870	One year.
NATHANIEL J. BRADLEE, 1863, 64, 65, 66, 67, 68, 69, 70, and 71†	Nine years.
GEORGE LEWIS, 1868, 69, 70, and 71†	Four years.
SIDNEY SQUIRES, 1871†	One year.
CHARLES H. HERSEY, 1872	One year.
CHARLES H. ALLEN, 1869, 70, 71, and 72	Four years.
ALEXANDER WADSWORTH, *1864, 65, 66, 67, 68, 69, and 72	Seven years.
CHARLES R. MCLEAN, 1867, 73, and 74†	Three years.
EDWARD P. WILBUR, 1873 and 74	Two years.
JOHN A. HAVEN, 1870, 71, 72, 73, and 74†	Five years.
THOMAS GOGIN, 1873, 74, and 75*	Three years.
AMOS L. NOYES, 1871, 72, and 75	Three years.
WILLIAM G. THACHER, 1873, 74, and 75†	Three years.
CHARLES J. PRESCOTT, 1875	One year.
EDWARD A. WHITE, 1872, 73, 74, 75, and 76††	Five years.
LEONARD R. CUTTER, 1871, 72, 73, 74, 75, and 76†	Six years.
L. MILES STANDISH, 1860, 61, 63, 64, 65, 66, 67, 74, 75, and 76††	Ten years.
CHARLES E. POWERS, *1875 and 1876†	Two years.
SOLOMON B. STEBBINS, 1876†	One year.
NAHUM M. MORRISON, 1876†	One year.
AUGUSTUS PARKER, 1876†	One year.

*Mr. John H. Wilkins resigned Nov. 15, 1855, and Charles Stoddard was elected to fill the vacancy. Mr. Henry B. Rogers resigned Oct. 22, 1865. Mr. Wilkins was re-elected Feb., 1856, and chosen President of the Board, which office he held until his resignation, June 5, 1860, when Mr. Ebenezer Johnson was elected President; and July 2 Mr. L. Miles Standish was elected to fill the vacancy occasioned by the resignation of Mr. Wilkins. Otis Norcross resigned Jan. 15, 1867, having been elected Mayor of the City. Benjamin James served one year, in 1858, and was reelected in 1868. Alexander Wadsworth served six years, 1864-69, and was reelected in 1872. Thomas Gogin resigned May 31, 1875. Charles E. Powers was elected July 15, to fill the vacancy occasioned by the resignation of Mr. Gogin.

† Served until the organization of the Boston Water Board.

†† Deceased.

BOSTON WATER BOARD,

Organized July 31, 1876.

TIMOTHY T. SAWYER, from July 31, 1876, to May 5, 1879; and from May 1, 1882, to May 4, 1883.

LEONARD R. CUTTER, from July 31, 1876, to May 4, 1883.

ALBERT STANWOOD, from July 31, 1876, to May 7, 1883.

FRANCIS THOMPSON, from May 5, 1879, to May 1, 1882.†

WILLIAM A. SIMMONS, from May 7, 1883, to Aug. 18, 1885.

GEORGE M. HOBBS, from May 4, 1883, to May 4, 1885.

JOHN G. BLAKE, from May 4, 1883, to Aug. 18, 1885.

WILLIAM B. SMART, from May 4, 1885, to March 18, 1889.

HORACE T. ROCKWELL, from Aug. 25, 1885, to April 25, 1888.

PHILIP J. DOHERTY, from March 18, 1889, to May 4, 1891.

THOMAS F. DOHERTY, from Aug. 26, 1885, to May 5, 1890; and from May 4, 1891, to present time.

ROBERT GRANT, from April 25, 1888, to present time.

JOHN W. LEIGHTON, from May 5, 1890, to present time.

ORGANIZATION OF THE BOARD FOR YEAR 1891.

Chairman.

ROBERT GRANT.

Clerk.

WALTER E. SWAN.

City Engineer and Engineer of the Board.

WILLIAM JACKSON.

Water Registrar.

WILLIAM F. DAVIS.

Deputy Collector and Clerk, Mystic Department.

JOSEPH H. CALDWELL.

Superintendent of the Eastern Division of Cochituate Department.

DEXTER BRACKETT, to June 1 (resigned).

WILLIAM J. WELCH, from June 1.

Superintendent of the Western Division and Resident Engineer of Additional Supply.

DESMOND FITZGERALD.

Superintendent of Mystic Department.

EUGENE S. SULLIVAN.

† Deceased.

TABLE OF CONTENTS.

REPORT OF THE WATER BOARD :	PAGE
Disbursements	2
Revenue	2
Mystic debt	2
Water Registrar's Department	3
Eastern Division	3
Extension of mains, etc.	3
Consumption of water	3
Additional supply, Basin 6, Whitehall Pond, and Cedar Swamp	3-4
Quality of Water, etc.	5
Future supply	5-6
MAINTENANCE ACCOUNTS	6-9
EXPENDITURE ACCOUNTS IN DETAIL	9-10-15-16
COST OF CONSTRUCTION AND CONDITION OF THE DEBTS	11-12
MONEY EXPENDITURES	12-13
STOCK ACCOUNTS	14
LIST OF CONTRACTS	17-21
GENERAL STATISTICS. (See also summary of statistics, p. 124.)	22
REPORT OF SUPERINTENDENT OF EASTERN DIVISION	23-55
Distribution mains and hydrants	23-24
High-service works	24-25
District stables	25
Reservoirs	25
Waste detection	26
Deacon meter-system	26-27
Meters, water-posts and fountains	27-34
Tables of pipe laid, hydrants established, etc.	35-55
REPORT OF SUPERINTENDENT OF WESTERN DIVISION	56-72
Sudbury-river basins	56-63
Whitehall pond	63-64
Farm pond	64
Lake Cochituate	65-67
Aqueducts	68-70
Chestnut-hill, Brookline, and Fisher-hill reservoirs	70-71
Biological laboratory	71
Filtration	71
Pollution	71-72
Quality of water	72
Analyses and rainfall tables, etc.	73-87

	PAGE
REPORT OF THE ENGINEER	88-100
Yield of sources of supply	88
Sudbury reservoirs and Lake Cochituate	88-91
Aqueducts and distributing reservoirs	91-92
High-service pumping-stations	92-93
Mystic lake	93
Mystic sewer	93
Mystic conduit, reservoir, and pumping-station	94-95
Consumption	95-96
Deacon meters	96-97
Additional supply	97-99
In general	100
TABLES of consumption, diversion of Sudbury-river water, amounts drawn from Lake Cochituate, rainfall, operations of pumping- stations, etc.	101-115
REPORT OF SUPERINTENDENT OF MYSTIC DIVISION	116-123
SUMMARY OF STATISTICS	124-126
CIVIL ORGANIZATION OF THE BOARD, 1845-1892	127-130







